

(No Model.)

3 Sheets—Sheet 2.

H. HOLLERITH.
ELECTRICAL CALCULATING SYSTEM.

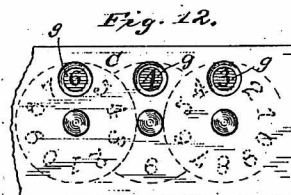
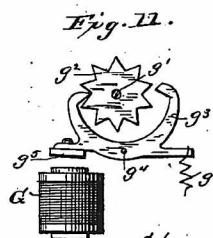
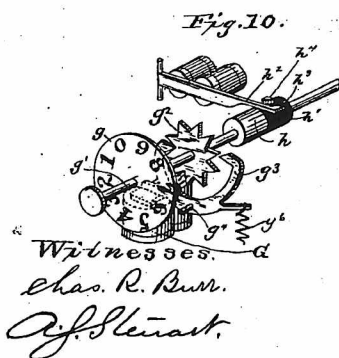
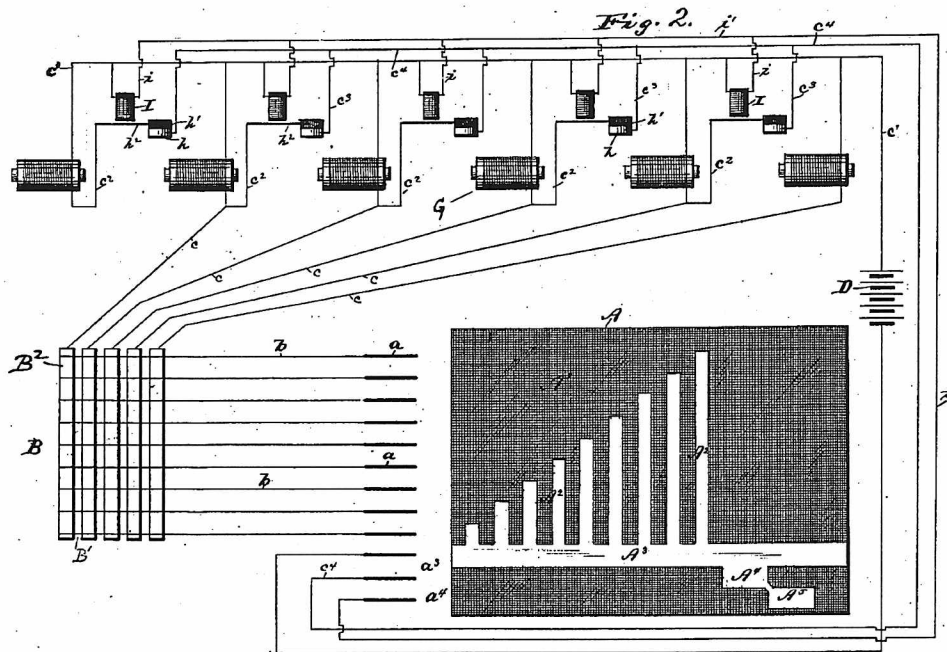
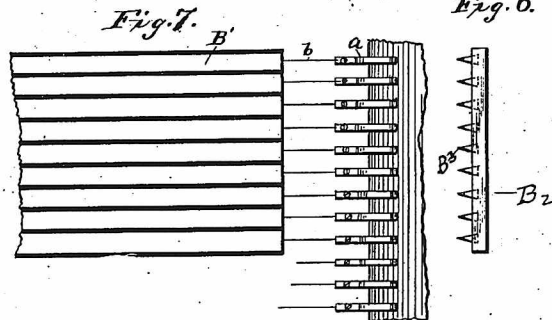
No. 430,804.

Patented June 24, 1890.

Filed
Jan 4, 1887

Fig. 4.

Z										E ²									
1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1				
2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2				
3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3				
4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4				
5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5				
6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6				
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8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8				
9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9				



Inventor.
Herman Hollerith
by Church & Church
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TABULATING SYSTEM.

No. 518,885.

Patented Apr. 24, 1894.

Fig. 11.

000	000	0000	000	000	0000	0000
111	111	1111	111	111	1111	1111
222	222	2222	222	222	2222	2222
333	333	3333	333	333	3333	3333
444	444	4444	444	444	4444	4444
555	555	5555	555	555	5555	5555
666	666	6666	666	666	6666	6666
777	777	7777	777	777	7777	7777
888	888	8888	888	888	8888	8888
999	999	9999	999	999	9999	9999
Total Acres.	Total Improved.	Value Farm.	Value Implements.	Value Stock.	Value Products.	

Fig. 12.

000	000	0000	000	000	0000	00000
111	111	1111	111	111	1111	11111
222	222	2222	222	222	2222	22222
333	333	3333	333	333	3333	33333
444	444	4444	444	444	4444	44444
555	555	5555	555	555	5555	55555
666	666	6666	666	666	6666	66666
777	777	7777	777	777	7777	77777
888	888	8888	888	888	8888	88888
999	999	9999	999	999	9999	99999
Total Acres.	Total Improved.	Value Farm.	Value Implements.	Value Stock.	Value Products.	

Fig. 13.

000	000	0000	000	000	0000	00000
111	111	1111	111	111	1111	11111
222	222	2222	222	222	2222	22222
333	333	3333	333	333	3333	33333
444	444	4444	444	444	4444	44444
555	555	5555	555	555	5555	55555
666	666	6666	666	666	6666	66666
777	777	7777	777	777	7777	77777
888	888	8888	888	888	8888	88888
999	999	9999	999	999	9999	99999
Total Acres.	Total Improved.	Value Farm.	Value Implements.	Value Stock.	Value Products.	

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UNITED STATES PATENT OFFICE.

HERMAN HOLLERITH, OF WASHINGTON, DISTRICT OF COLUMBIA.

TABULATING SYSTEM.

SPECIFICATION forming part of Letters Patent No. 518,885, dated April 24, 1894.

Application filed August 1, 1893. Serial No. 482,097. (No model.)

To all whom it may concern:

Be it known that I, HERMAN HOLLERITH, of Washington, District of Columbia, have invented certain new and useful Improvements in Tabulating or Calculating Systems; and I do hereby declare the following to be a full, clear, and exact description of the same, reference being had to the accompanying drawings, forming a part of this specification, in which—

Figure 1 is a diagrammatic view of one of the primary embodiments of my system. Fig. 2 is a vertical sectional view of the switch mechanism, the record card being omitted. Fig. 3, is a plan view of a record card. Fig. 4 is a diagrammatic view illustrating another embodiment of the system; Fig. 5, a top plan of an improved form of integrator mechanism; Fig. 6 a front elevation; Fig. 7 an end elevation, and Fig. 8 a cross sectional view of the same on line $x-x$ Fig. 5. Figs. 9 and 9^a are detail views of a portion of the detent mechanism. Fig. 10, is a diagrammatic view illustrating the application in the system of the improved integrator mechanism shown in Figs. 5 to 9. Fig. 11 is a plan view of a properly punched record such as designed for use in connection with the embodiments of the system shown in Figs. 4 and 10. Fig. 12 is a plan view of a record card which has been insufficiently punched. Fig. 13, is a similar view of an overpunched card.

I have invented what I believe to be certain novel and highly useful improvements in tabulating or calculating systems, and in order that the higher developments of the invention may be more readily apprehended, I will premise by describing one of its primary forms, reference being had, for this purpose, to Figs. 1 to 3, of the accompanying drawings.

This embodiment of my invention, shown in said figures involves the use of the following instrumentalities: first, a series of independent electrically controlled counters or registers and appropriate circuit connections; secondly, an integrator capable of producing in each series of circuit connections leading therefrom a different number of electrical impulses or interruptions; thirdly, a switch mechanism controlling communication between the several circuit connections leading from the integrator and the circuit connec-

tions leading to the several counters or registers; and, fourthly, an actuating or master circuit closed by the movement of the switch mechanism, and controlling the starting and stopping of the integrator.

The switch mechanism as shown in Figs. 1 and 2 comprises a fixed bed plate C' provided with insulated contacts or terminals c in the form of mercury cups or equivalent contacts, and a movable platen, or what I prefer to call "pin box" C^2 carrying yielding pins or contacts c^2 . The pin box is provided with suitable guiding and supporting means, and is held normally elevated, while a lever or other actuating device is provided for depressing it to bring the contacts c^2 into engagement with the contacts c .

The connections to be made through the switch mechanism are regulated and determined by a record card or strip—Fig. 3—provided with perforations (p) disposed according to a prearranged plan, interposed between the fixed and movable sections of the switch mechanism, so that, as the movable section or pin box is depressed, only those of the movable contacts or pins c^2 , which descend in line with the perforations p in the record card will be permitted to pass through the card and engage with their co-operating contacts c in the bed plate and thus close the circuits with which they are connected, all other contacts c^2 being held back and their circuits kept open by the bodily interposition of unperforated portions of the record card or strip as will be readily understood. The contacts c are electrically connected in groups 1^x to 9^x inclusive (see diagram Fig. 1) and the contacts or pins c^2 are also connected in groups numbered 4 to 24 inclusive, arranged at right angles to the groups 1^x to 9^x , there being at least nine contacts in each group, so arranged and disposed that one contact c^2 of each of said groups 4 to 24 will be opposite one contact c of each group 1^x to 9^x . Each group of contacts 1^x to 9^x is connected to one of the contacts or brushes b' to b^9 of the integrator B, Fig. 1, while each group of contacts 4 to 24 is connected to one of the counters or registers A through the circuit connection a leading to the magnet of said counter or register, the magnets of all the registers being connected to a common return conductor a' having in

terposed in it a generator D and terminating in a contact or brush b at the integrator.

Instead of forming permanent connection between groups 4 to 24 (the movable contacts of the switch) and the several register circuit connections a (as might be done) the former preferably terminate in pins or contacts c^3 carried by the movable pin box and co-operate with contacts c^4 in the bed plate, said contacts lying outside the record card when the latter is in position, so as to always close the circuits whether any of the other contacts in the same group are permitted to pass the card or not.

The movable pin box is provided with four additional or supplemental contacts 3, 25, 27 and 28, (Fig. 1) of which the first three have to do with the proper location of the record cards on or in the switch mechanism. Contacts 3 and 25 occupy positions along one edge of the pin box, opposite the side gage or gages g , and just beyond the margin of the record card when in position; while contact 27 is located at one end just beyond the record card opposite the end gage g' . As thus arranged if the record card is properly located it will not interfere with the descent of any of the contacts, but if shifted out of proper position, it will lie in the path of one or more of the contacts, and prevent further advance on the part of the contact thus engaged. These three contacts 3, 25 and 27 are located in the same circuit and all three must be in contact with the opposite electrodes or contacts 3^a , 25^a and 27^a to close the circuit, hence if any one is held back the circuit will remain open and the apparatus inactive, inasmuch as said contacts are located in what may be termed a master or starting circuit, which, in the present instance, includes the devices for setting in motion the integrator through which the several operating circuits extend. The contact 28 is also carried by the movable pin box and co-operates with the contact 28^a on the base; it, too, is located in the master circuit and is adjusted to effect the final closing and first opening of the circuit in which it is located, so that all the sparking in that circuit will occur at this one point where it can be most easily controlled and its injurious effects provided against.

The integrator B (shown diagrammatically in Fig. 1) is an apparatus for producing in each of a series of circuit connections leading to groups 1^x to 9^x a different series of electrical impulses of such form, duration and character as to affect the registering devices to advance them as many steps or units as there are electrical impulses sent over the particular circuit at the time including the particular register. In the example given, contacts or brushes b' to b^9 , inclusive, are the terminals of the groups of contacts 1^x to 9^x and they are arranged to be engaged intermittently by a series of contacts or bars b^{10} , mounted upon a rotating cylinder driven by a suitable motor and provided with a detent

mechanism, the latter controlled by a magnet e in the master or starting circuit. A contact or brush b forming one terminal of the generator circuit is also arranged to engage each of the contacts b^{10} , thereby completing the circuit through the latter and each of the contacts b' to b^9 . The contacts or bars b^{10} are so arranged and disposed upon the cylinder that during a complete movement of the latter, *i. e.*, a complete or partial rotation, contact or brush b' will be engaged by but one of said contacts b^{10} ; contact or brush b^2 , by two contacts; b^3 by three, and so on throughout the series, the last contact or brush b^9 , being engaged by nine contacts b^{10} .

The ultimate effect produced by one complete movement of the integrator is as follows: The master circuit being closed, the integrator cylinder is started and the current entering through contact or brush b , passes successively, through the contacts or bars b^{10} to contacts or brushes b' to b^9 , and each of said last named contacts receives a different number of electrical impulses, from 1 to 9. If, now, any of the circuits through the switch mechanism be closed through the registers or counters, the latter will be advanced as many points as there are pulsations produced in its circuit, and the number of pulsations will be governed by the record card in placing any one of the contacts b' to b^9 in communication with that particular register. It will be observed that the contacts of each group of contacts 1^x to 9^x can be placed in communication with the contacts of any one or more of the groups of contacts 4 to 24 thus closing circuit connections through one or more of the register magnets, and that each group of contacts 1^x to 9^x , through its connections with the integrator, receives and transmits a series of electrical pulsations corresponding to the assigned value of the group. Assuming, for the purpose of illustration, that the series of items embraced but the three groups of contacts 4, 5 and 6 (the number of contacts 4 to 24 apportioned to any given series of calculations being a matter of choice) and that the value to be registered or added is 562, the record card will be perforated at the fifth division from the top in the column corresponding to group 4, in the sixth division of group 5 and in the second division of group 6. The card having been properly located on the platen, when the pin box is brought down the circuit connections will be closed through the register magnets and integrator, and five pulsations will be sent through the register magnet belonging to group of contacts 4, six pulsations will be sent through group 5 and two through group 6, each register being advanced the number of digits represented by the perforations in the column of the record card belonging to that particular register. If the record card is not placed fairly in position on the bed plate so that the contacts 3, 25 and 27 will pass the edges, one or more of said contacts will engage the card, thereby preventing the

closing of the master circuit and the starting of the integrator, which fact will be observed by the operator who will thus be admonished that the record card is not properly adjusted.

5 A check is thus provided for one source of errors, those liable to arise from the failure to properly position the record card so as to bring the several divisions in register with the contacts of the pin box, and if the records

10 made on the record cards were absolutely accurate the system thus far described would be adequate for most purposes. But in actual operation it has been found that there are certain difficulties arising mainly from care-

15 lessness or inaccuracy on the part of the operator in preparing the record cards. First. The clerk whose duty it is to prepare the record card may fail to punch some of the digits representing items or values entering

20 into the computation. Second. Two or more holes may be punched in one column (each column representing one of the groups of contacts 4 to 24) and none in another. Third. The card may be placed in the machine

25 crooked, or the holes be punched out of position so that some pins which ought to go down will be held up, thus causing a failure to register. Fourth. Some pin or pins in the pin box may be broken or stuck, thereby pre-

30 venting the closing of one or more of the circuits designated by the holes in the record card. Fifth. Two holes may be punched in one column while at least one hole is punched in every other column. Experience has amply

35 demonstrated that these are not imaginary, but are actual difficulties certain to occur in practice, and are productive of serious results, so far as accuracy is concerned. In the first place, the omission of holes that should

40 have been punched, the presence of broken pins, or the sticking of the pins, &c., will affect the results by the omission of a corresponding amount, *i. e.*, the value of the items not registered. When, however, two or more

45 holes are punched in one column a rather startling result will be obtained. Suppose, for example, a hole is punched in every column corresponding to the value 1. Each counter should and ordinarily would register

50 1. If, however, in any column an additional hole is punched representing a higher value so as to make two holes in one column—then each counter instead of registering 1 will register according to the value of the additional

55 hole of higher value. To illustrate: Suppose a hole is punched in the first and ninth divisions of the first column connecting groups 9^x and 4 (see Fig. 1), nine impulses will be transmitted through the register magnet and the counter will be advanced nine points.

60 If, at the same time, a hole is punched in the first division of the second column so that groups 1^x and 5 will be connected, the magnet of the register belonging to the second

65 column or group 5 instead of receiving one impulse only, as it should, will receive nine impulses, because the current transmitted

through contact or brush b⁹ will be conducted from group 9^x through group 4 to group 1^x and thence to group 5 and to the register magnet. Thus, the pulsations or impulses delivered to group 9^x from contact or brush b⁹ and designed to influence only such of the register magnets as are connected by holes in the ninth divisions of each column or group

70 4 to 24, are diverted onto the group 1^x, by the perforation in the first division, and are transmitted to all register magnets at the time connected with a contact in group 1^x through a hole in the first division. It will be seen that

75 if 1 and 9 be punched in any one column, every other 1 in the other columns will register 9, be it units, tens, thousands or millions. A corresponding improper registration will take place upon the forming of multiple holes in

80 any column of the record card, the hole of higher value always dominating. With a view to overcoming the defects noted and thereby eliminating those errors due to the inaccuracy of the person who prepares the

85 record card or strip, I have devised and invented certain improvements in the nature of modifications and extensions of the primary system, and especially designed first to prevent the registration of cards not containing

90 at least one hole in each column, thus requiring the punching of a hole in each column in order to effect any registration whatever; and, secondly, to indicate a mistake resulting from double punching or the punching

95 of more than one hole in any column of the card, thereby enabling a timely correction of the error to be made.

The improvements designed to detect record cards in which each column is not represented by at least one punched hole, or, in other words, to detect record cards bearing incomplete records will first be described.

100 As may already have been anticipated, this feature of my invention is based upon and involves the punching of at least one hole in every column of the record card whether the hole punched represents a value to be registered or not, thus requiring that a hole be punched at some point in each column in

105 order to render the card, as a whole, operative to actuate the registering mechanism. In carrying this idea into practice the first step involved is the provision of an additional series of divisions on the card (by divisions I

110 mean prearranged locations on the card apportioned among the various items or series of items designated by the punched holes) one for each column representing say, 0, (see Figs. 11, 12 and 13,) which additional division or 0,

115 is designed to be punched whenever there is no value to be recorded in the particular column. Thus if 60 is to be recorded on the card, the sixth division in the tens column will be punched and there being nothing in

120 the units column to be recorded instead of skipping that column as heretofore, the 0 therein will be punched.

125 The next step is the provision of an addi-

No. 638,591.

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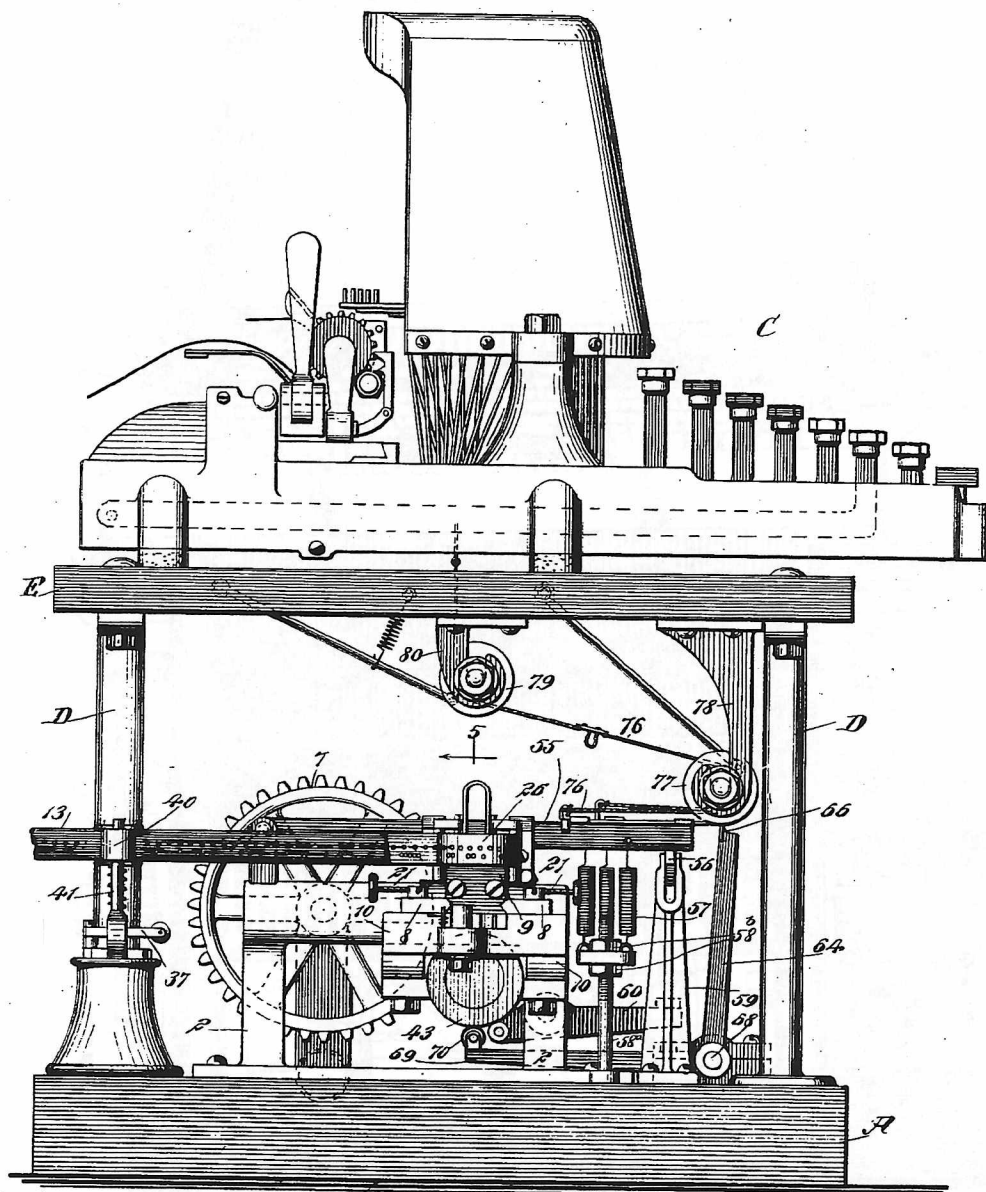
Patented Dec. 5, 1899.

ACTUATING MECHANISM FOR KEY OPERATED MACHINES.

(No Model.)

(Application filed May 4, 1899.)

16 Sheets—Sheet 1.



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Fig 1

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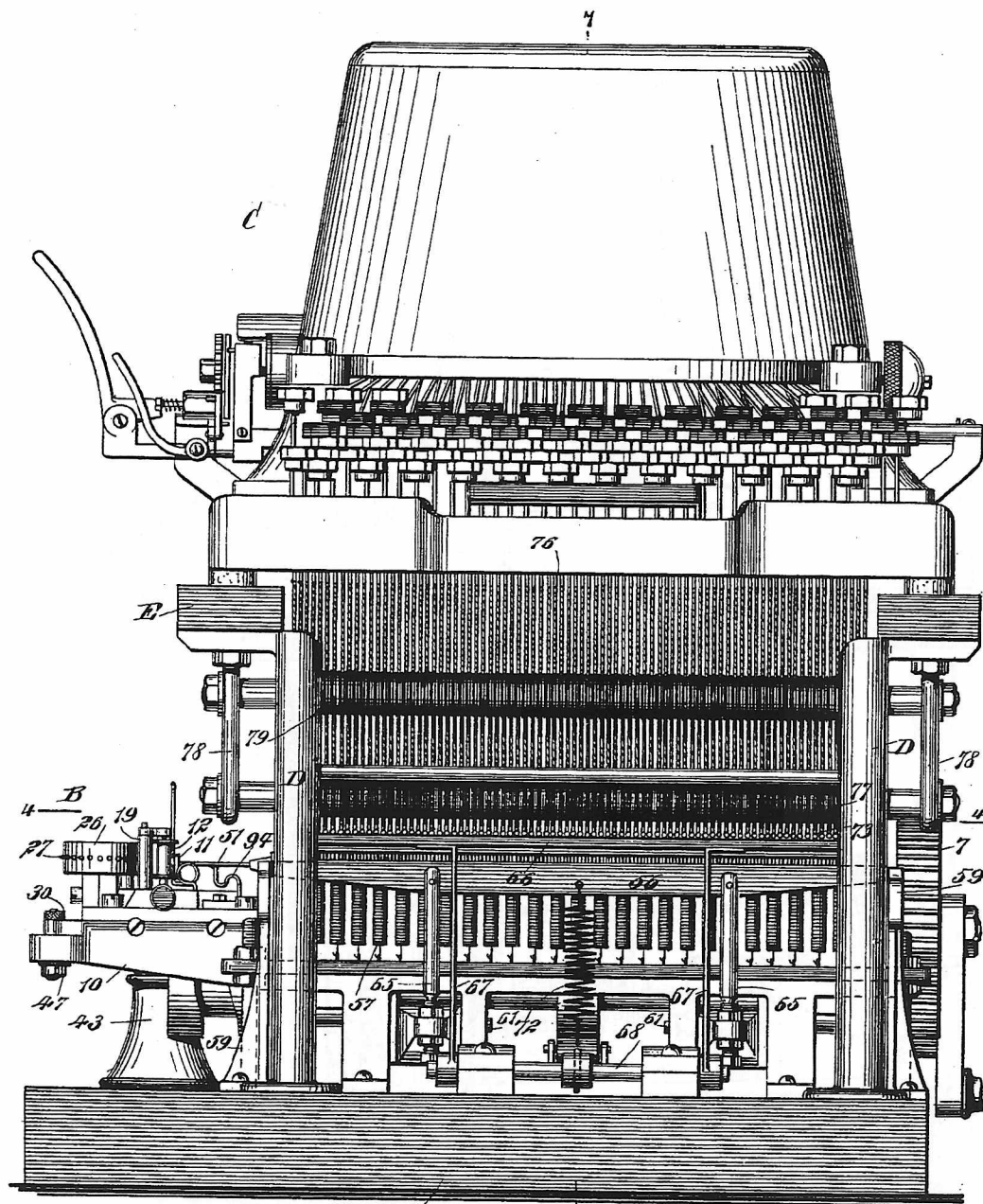
D. MURRAY.

ACTUATING MECHANISM FOR KEY OPERATED MACHINES.

(No Model.)

(Application filed May 4, 1899.)

16 Sheets—Sheet 2.



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Fig. 2

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ACTUATING MECHANISM FOR KEY OPERATED MACHINES.

(No Model.)

(Application filed May 4, 1899.)

16 Sheets—Sheet 3.

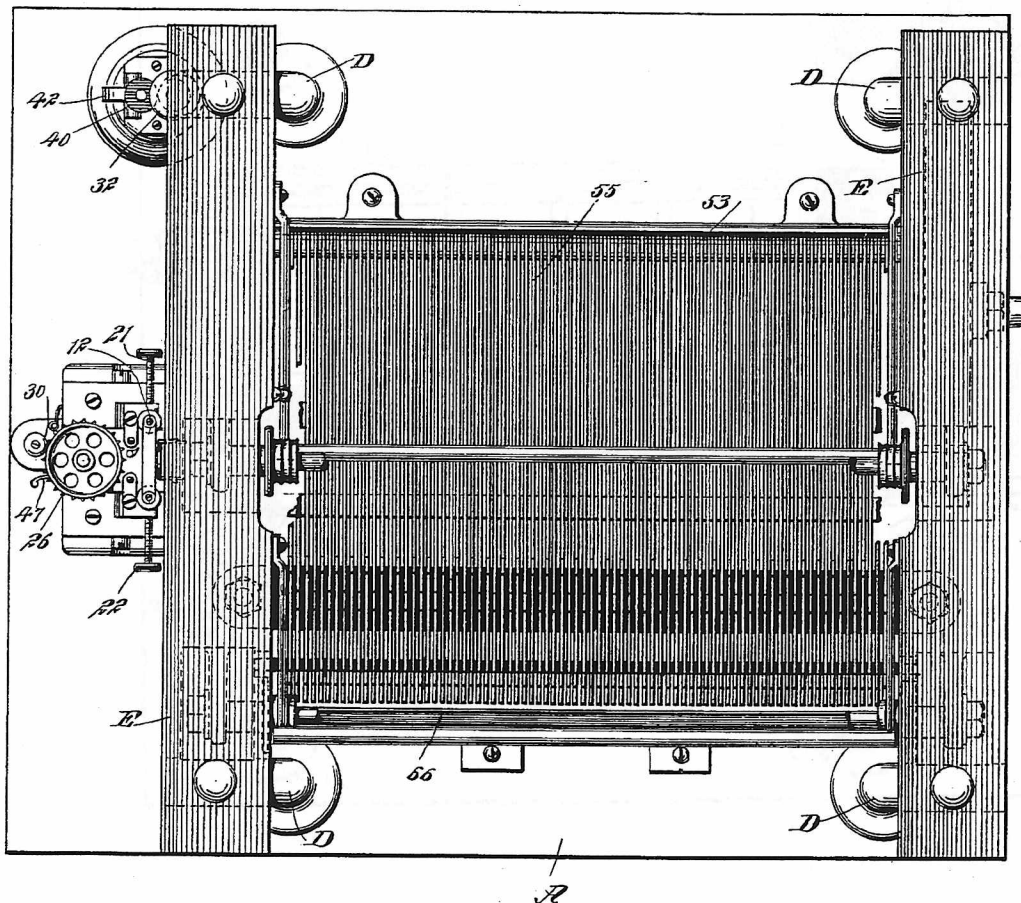


Fig. 3

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(No Model.)

(Application filed May 4, 1899.)

16 Sheets—Sheet 4.

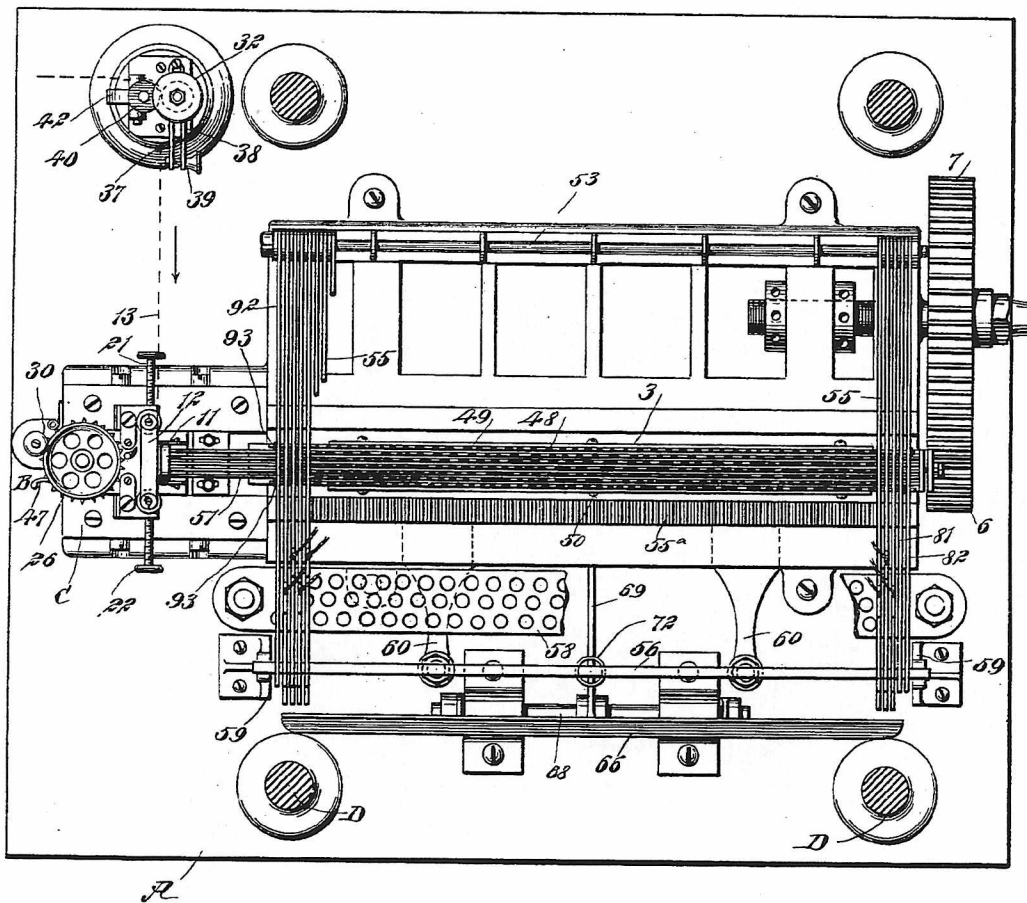


Fig. 4

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ACTUATING MECHANISM FOR KEY OPERATED MACHINES.

(No Model.)

(Application filed May 4, 1899.)

16 Sheets—Sheet 5.

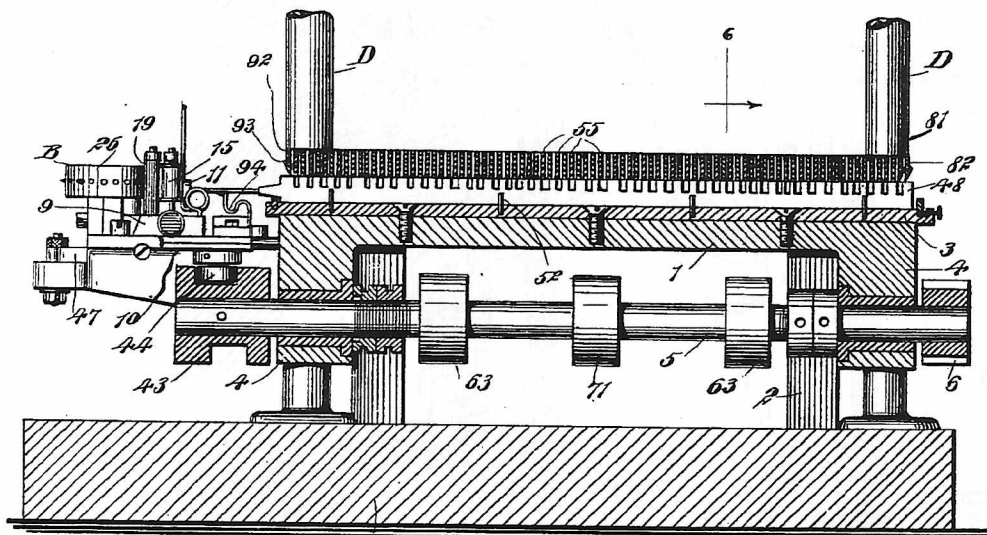


Fig. 5

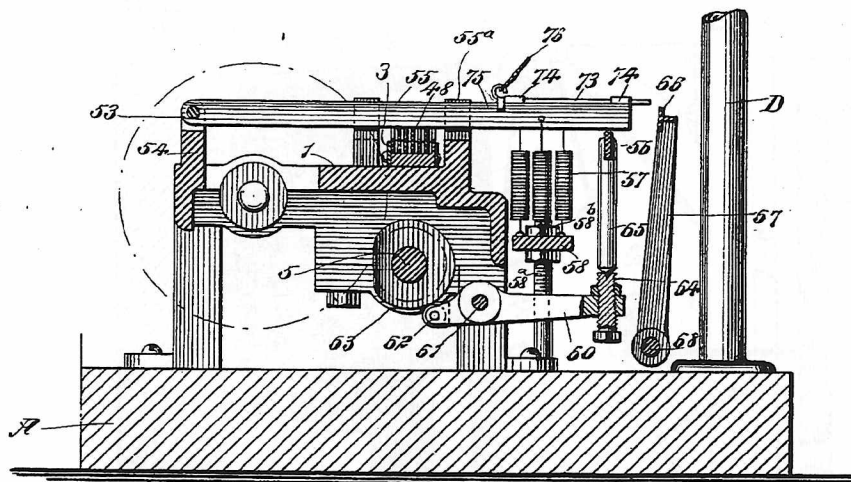


Fig. 6

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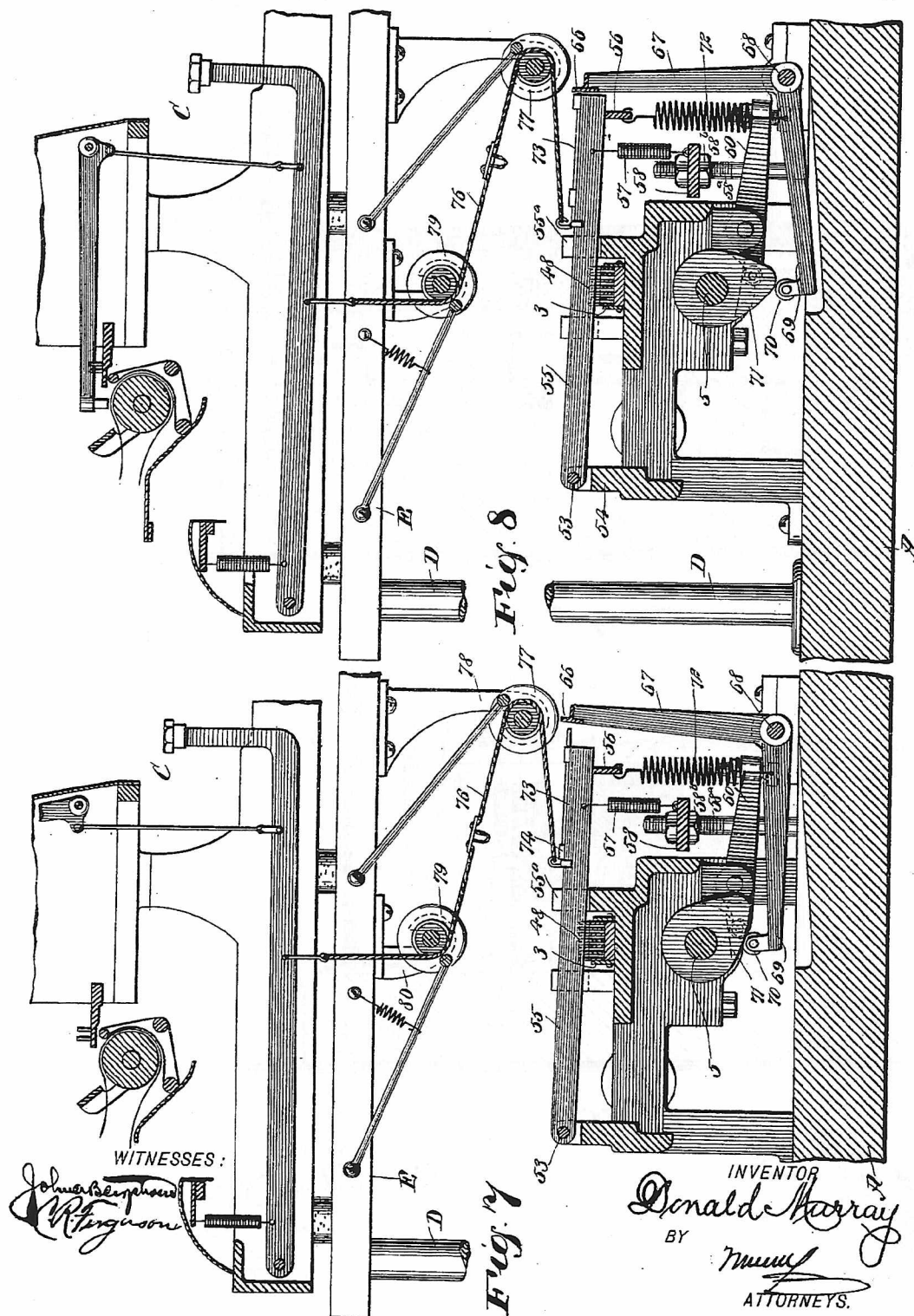
THE MORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

Patented Dec. 5, 1899.

ACTUATING MECHANISM FOR KEY OPERATED MACHINES.

(Application filed May 4, 1899.)

16 Sheets—Sheet 6.



THE MORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

No. 638,591.

Patented Dec. 5, 1899.

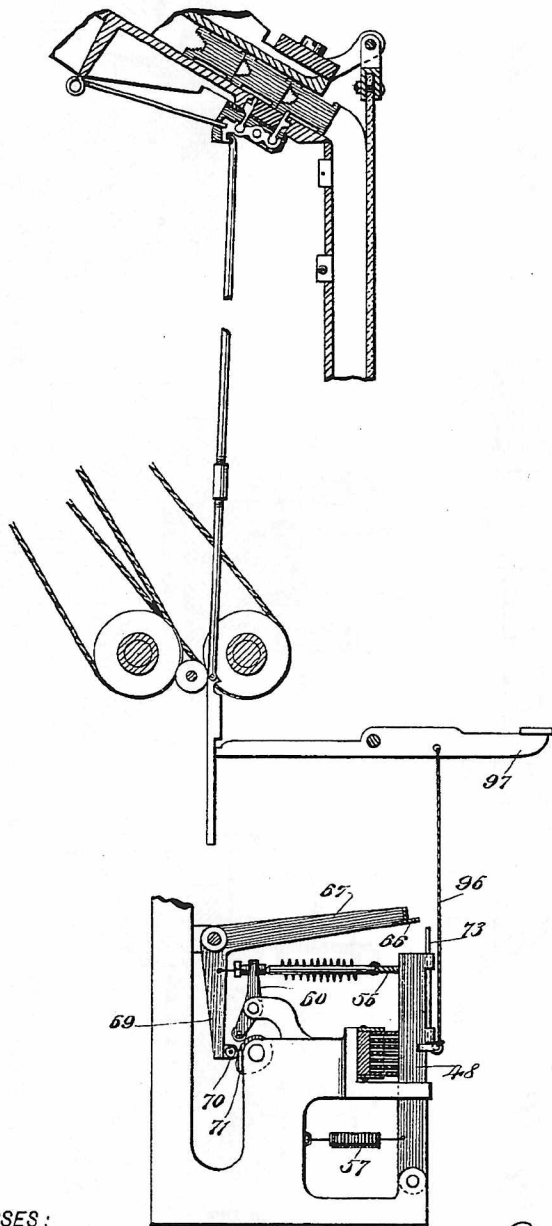
D. MURRAY.

ACTUATING MECHANISM FOR KEY OPERATED MACHINES.

(No Model.)

(Application filed May 4, 1899.)

16 Sheets—Sheet 7.



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Fig. 9

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ACTUATING MECHANISM FOR KEY OPERATED MACHINES.

(No Model.)

(Application filed May 4, 1899.)

16 Sheets—Sheet 8.

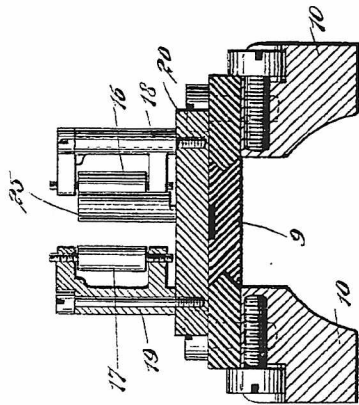


Fig. 11

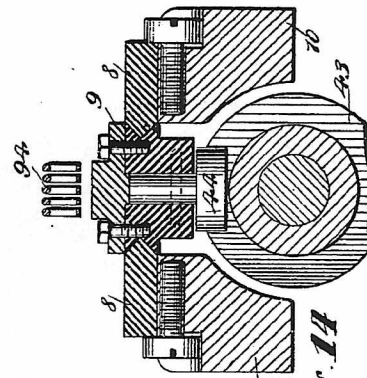


Fig. 14

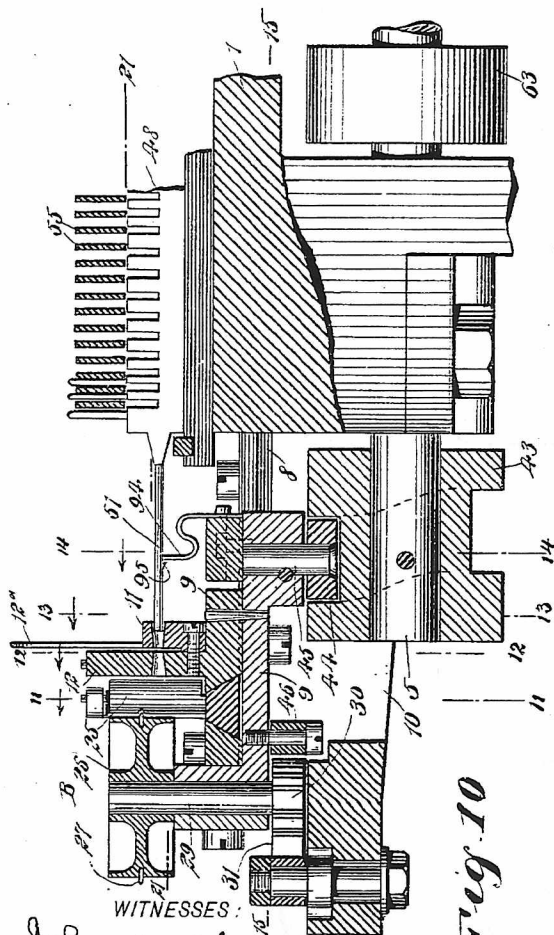


Fig. 10

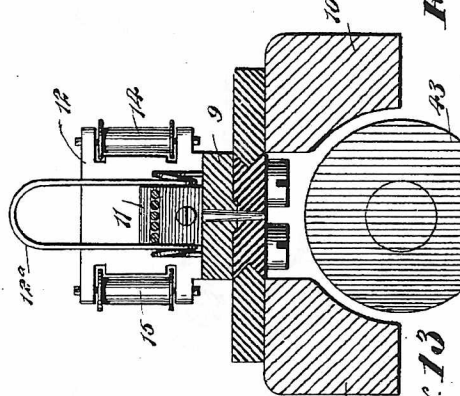


Fig. 13

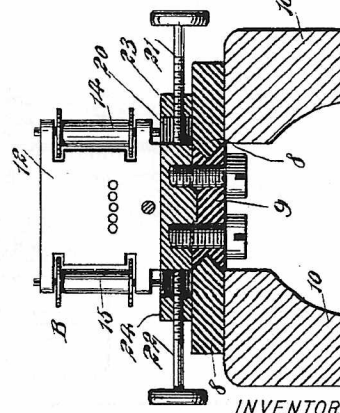


Fig. 12

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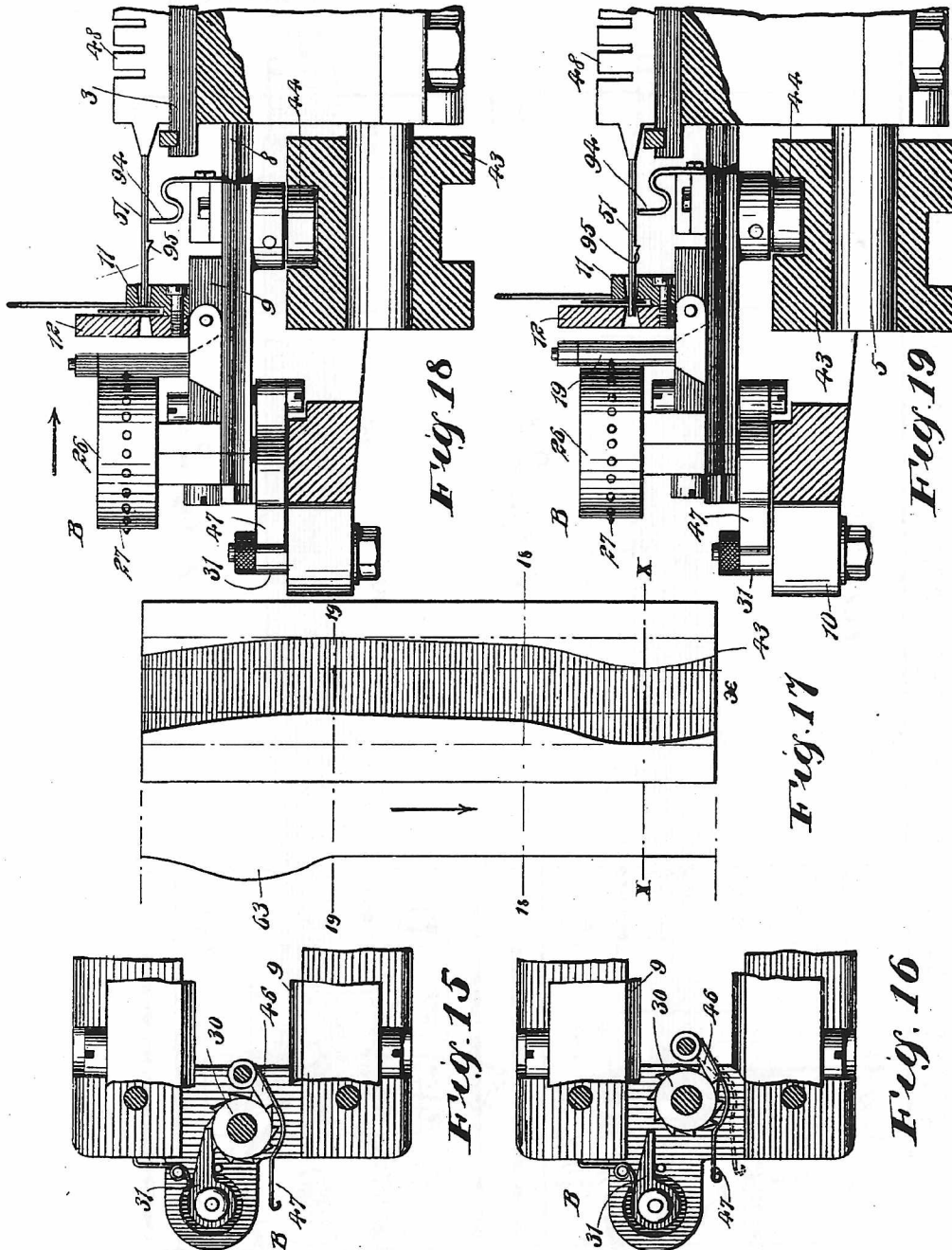
D. MURRAY.

ACTUATING MECHANISM FOR KEY OPERATED MACHINES.

(No Model.)

(Application filed May 4, 1899.)

16 Sheets—Sheet 9.



WITNESSES:
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No. 638,591.

Patented Dec. 5, 1899.

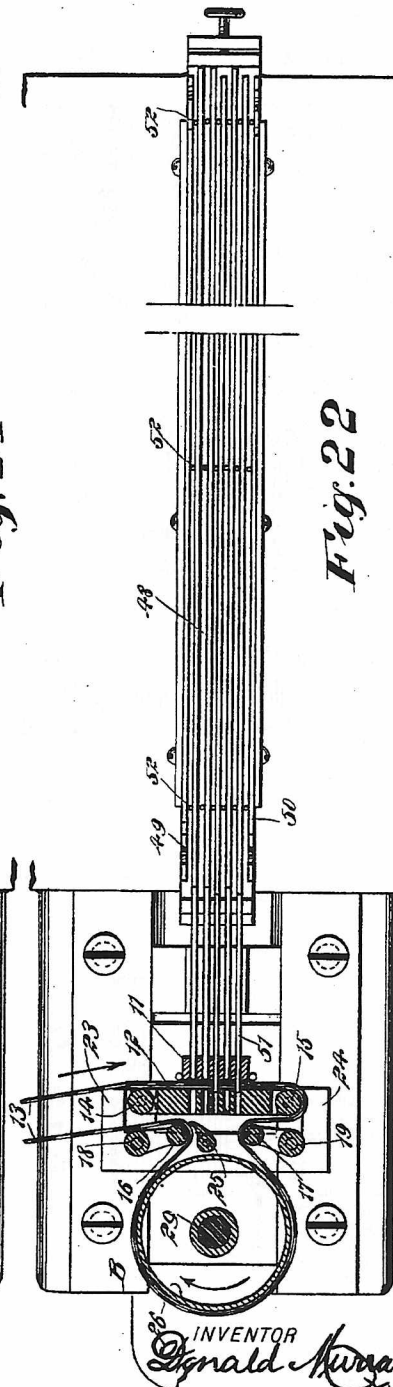
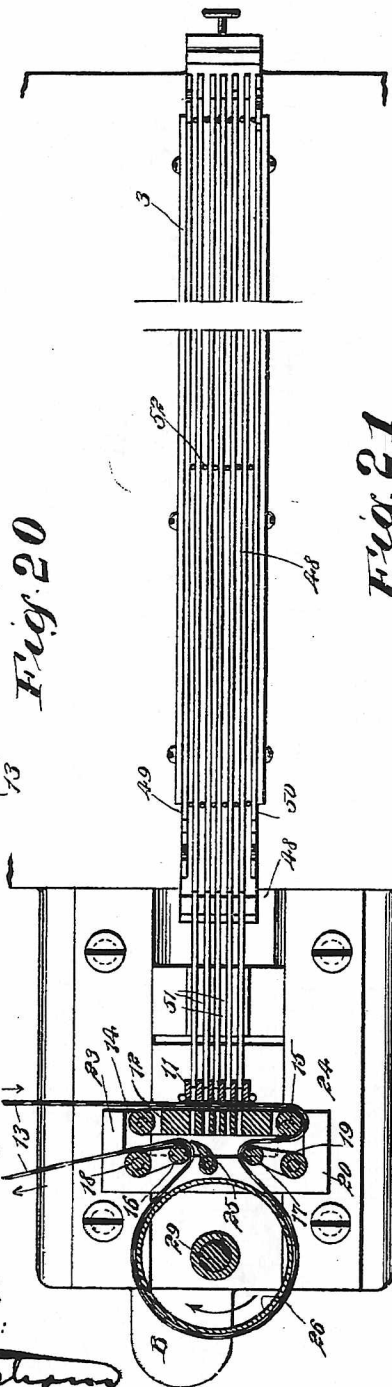
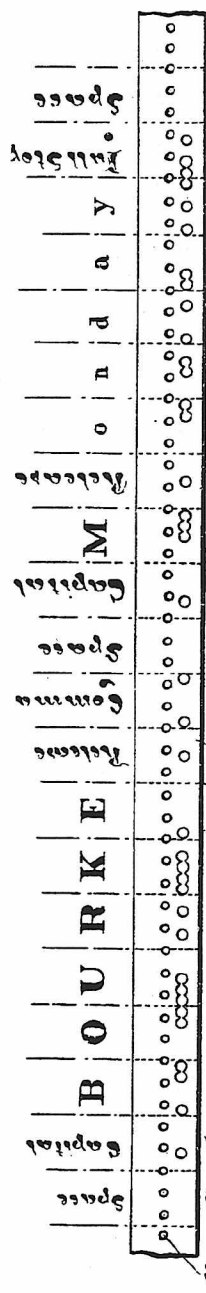
D. MURRAY.

ACTUATING MECHANISM FOR KEY OPERATED MACHINES.

(Application filed May 4, 1899.)

(No Model.)

16 Sheets—Sheet 10.



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Patented Dec. 5, 1899.

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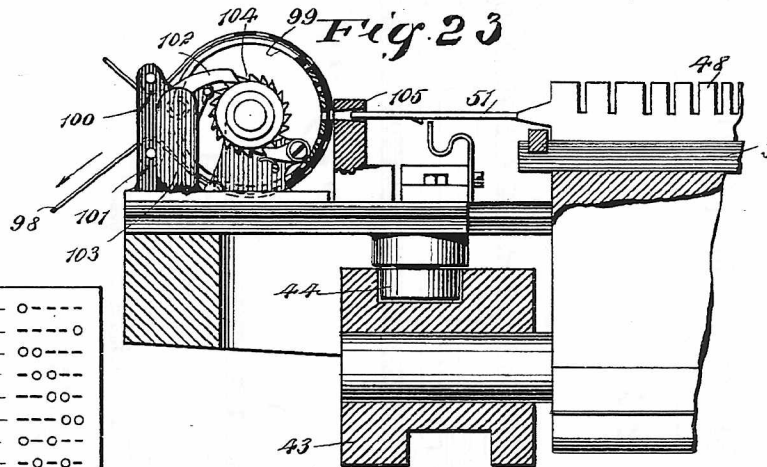
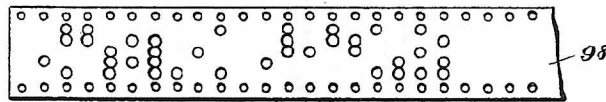
ACTUATING MECHANISM FOR KEY OPERATED MACHINES.

(Application filed May 4, 1899.)

(No Model.)

16 Sheets—Sheet II.

BOURKE, Monday.



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n	---	o	---
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s	---	o	---
r	---	o	---
h	---	o	---
d	---	o	---
l	---	o	---
u	---	o	---
e	---	o	---
m	---	o	---
f	---	o	---
w	---	o	---
y	---	o	---
p	---	o	---
b	---	o	---
g	---	o	---
v	---	o	---
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q	---	o	---
j	---	o	---
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,	---	o	---
.	---	o	---
Space Key	---	o	---
Capital Key	---	o	---
Figure Key	---	o	---
Release Key	---	o	---

Fig. 24

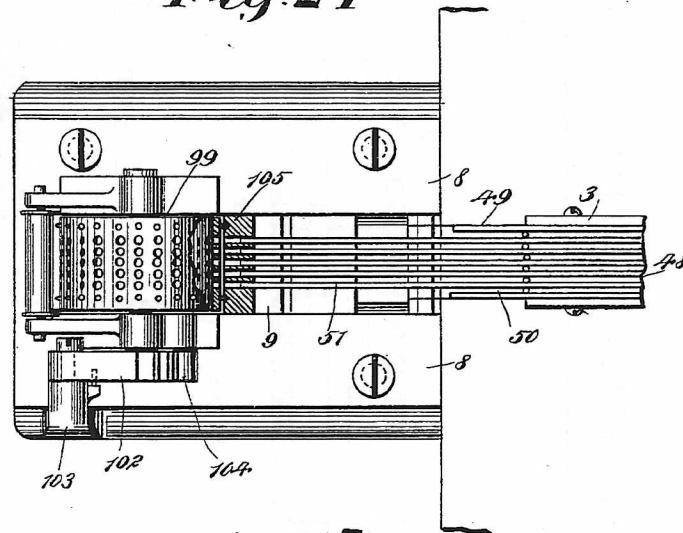


Fig. 23a

Fig. 25

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No. 638,591.

Patented Dec. 5, 1899.

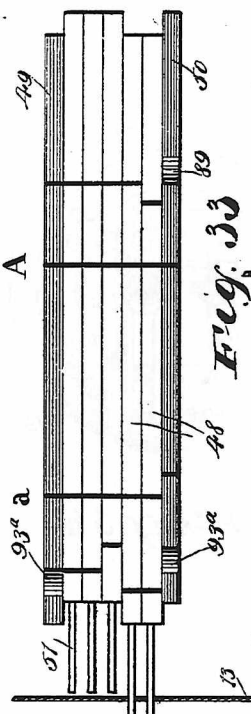
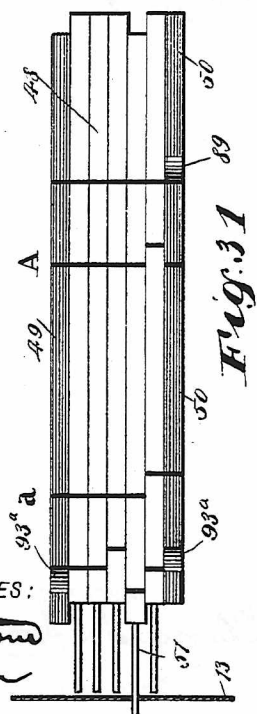
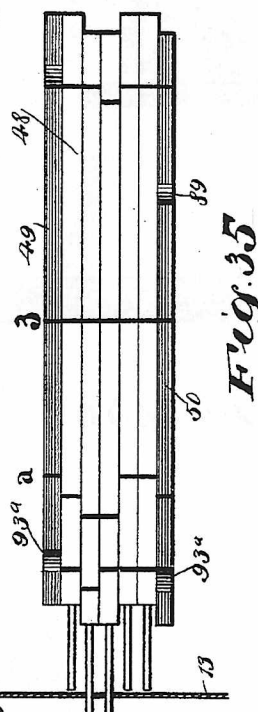
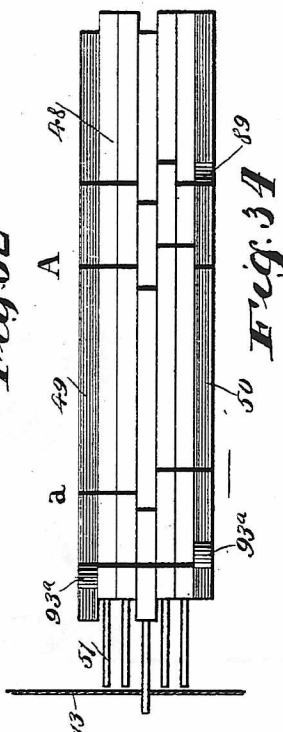
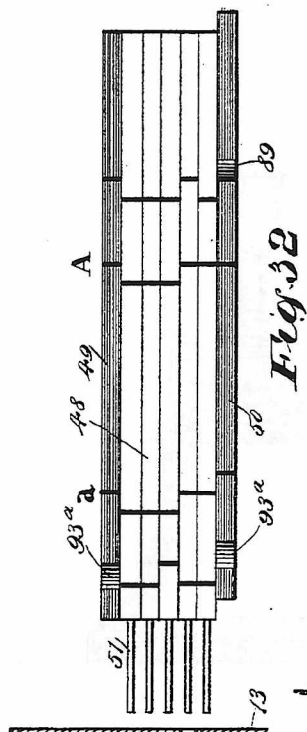
D. MURRAY.

ACTUATING MECHANISM FOR KEY OPERATED MACHINES.

(Application filed May 4, 1899.)

(No Model.)

16 Sheets—Sheet 13.



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ACTUATING MECHANISM FOR KEY OPERATED MACHINES.

(Application filed May 4, 1899.)

(No Model.)

16 Sheets—Sheet 14.

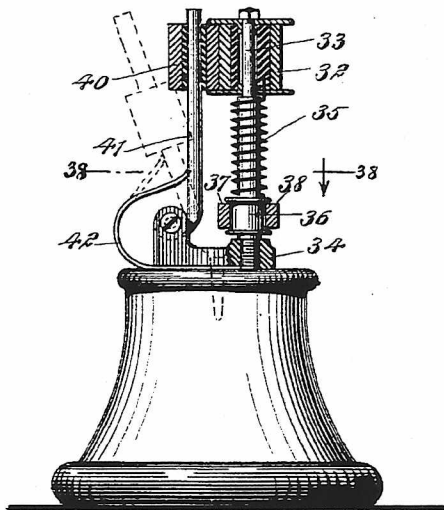


Fig. 36

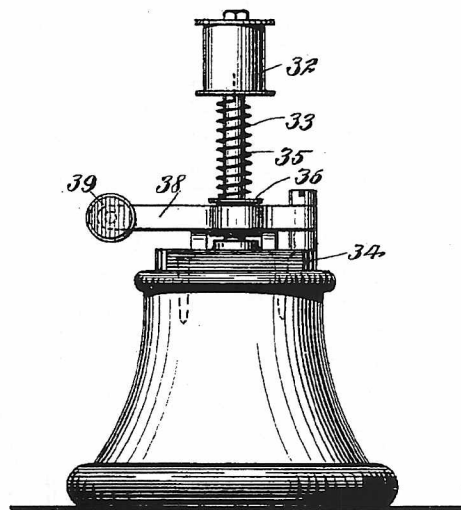


Fig. 37

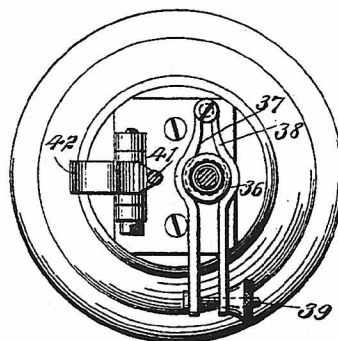


Fig. 38

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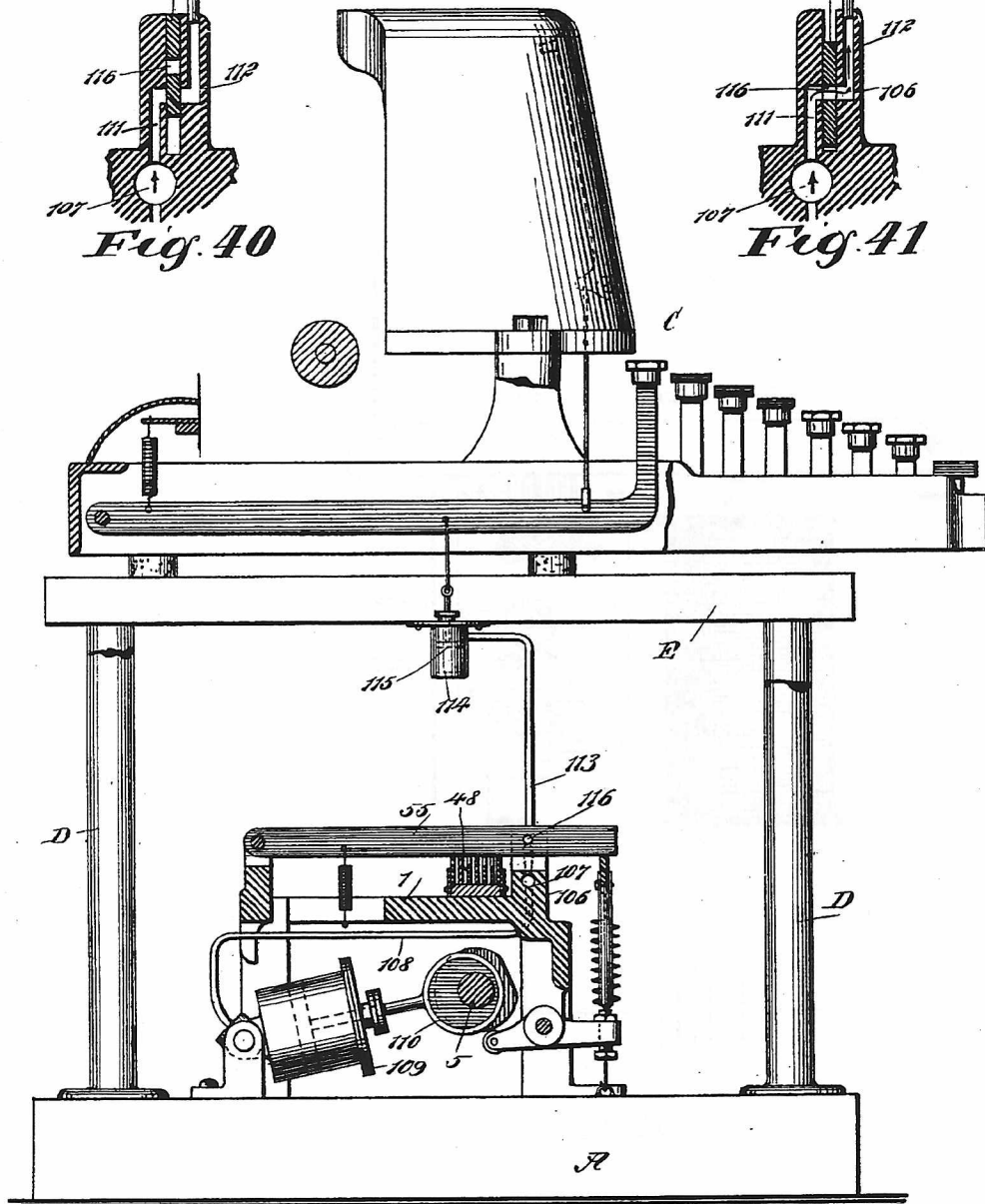
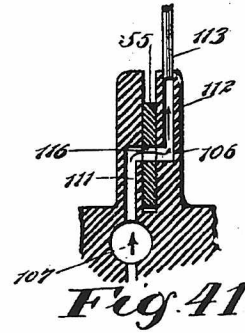
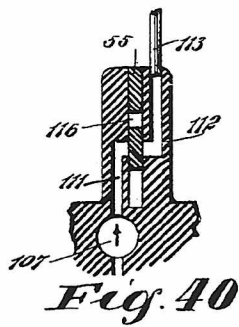
D. MURRAY.

ACTUATING MECHANISM FOR KEY OPERATED MACHINES.

(Application filed May 4, 1899.)

(No Model.)

16 Sheets—Sheet 15.



WITNESSES:

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Fig. 39

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D. MURRAY.

ACTUATING MECHANISM FOR KEY OPERATED MACHINES.

(No Model.)

(Application filed May 4, 1899.)

16 Sheets—Sheet 16.

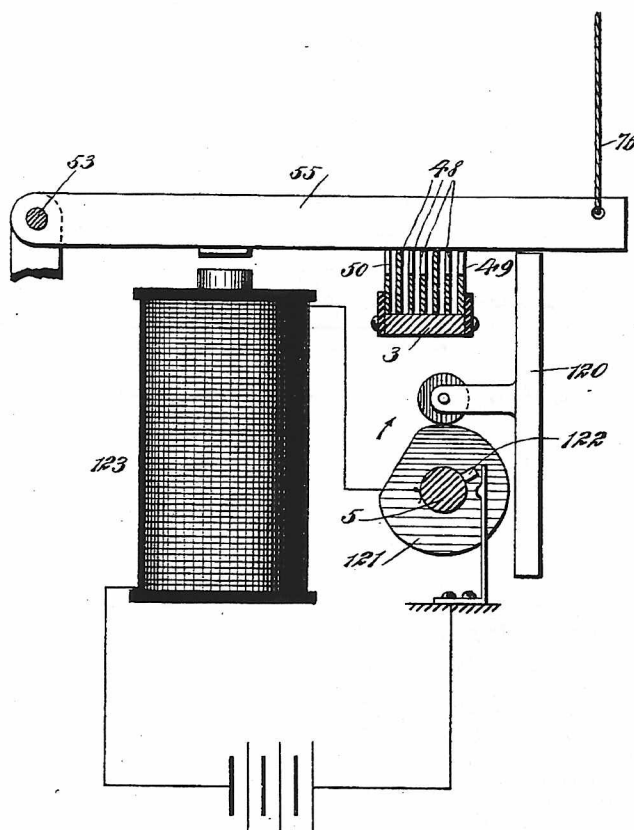


Fig. 42

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UNITED STATES PATENT OFFICE.

DONALD MURRAY, OF SYDNEY, NEW SOUTH WALES.

ACTUATING MECHANISM FOR KEY-OPERATED MACHINES.

SPECIFICATION forming part of Letters Patent No. 638,591, dated December 5, 1899.

Application filed May 4, 1899. Serial No. 715,521. (No model.)

To all whom it may concern:

Be it known that I, DONALD MURRAY, of Sydney, New South Wales, have invented a new and Improved Actuating Mechanism for Key-Operated Machines, of which the following is a full, clear, and exact description.

This invention relates to improvements in actuating mechanism for keyboard-operated machines of the class used for the dissemination of intelligence, embracing linotype, type-setting machines, type-writing machines, and the like.

The object of the invention is to provide a new and improved device for operating such machines automatically and in such a manner that accurate work is produced without danger of derangement of the organism of such machines, at the same time leaving such machines at all times in condition for being operated by hand in the way now generally practiced.

A further object of the invention is to furnish syndicates, press associations, news agencies, and other centers of intelligence with simple means for convenient, quick, and immediate distribution to their customers and subscribers, so as to enable the latter to expeditiously and automatically convert, by the use of the type-machine, the intelligence received into type matter for printing serial stories, special articles, and telegraphic cable, or other news without the assistance of any skilled labor whatever.

The invention consists of novel features and parts and combinations of the same, as will be fully described hereinafter and then pointed out in the claims.

A practical embodiment of my invention is represented in the accompanying drawings, forming a part of this specification, in which similar characters of reference indicate corresponding parts in all the views.

Figure 1 is an end elevation of a device embodying my invention and shown in connection with a type-writing machine to be actuated by the improvement. Fig. 2 is a front elevation of the same. Fig. 3 is a top plan of the same with the type-writing machine removed. Fig. 4 is a sectional plan view of the same on the line 4 4 in Fig. 2. Fig. 5 is a sectional front elevation of the same on the line 5 5 in Fig. 1. Fig. 6 is a transverse sec-

tion of the same on the line 6 6 in Fig. 5. Fig. 7 is a cross-section of the improvement as applied to a type-writing machine, the section being taken on the line 7 7 in Fig. 2 and showing a striking device employed as just beginning to operate. Fig. 8 is a similar section showing the striker as operated. Fig. 9 shows a method of attaching the invention to a linotype-machine. Fig. 10 is an enlarged sectional front elevation of a portion of the device to clearly illustrate the reciprocating carriage and the tape-feeding mechanism employed. Fig. 11 is a transverse section of the same on the line 11 11 in Fig. 10. Fig. 12 is a like section of the same on the line 12 12 in Fig. 10. Fig. 13 is a similar section of the same on the line 13 13 in Fig. 10. Fig. 14 is a like section of the same on the line 14 14 in Fig. 10. Fig. 15 is a sectional plan view of part of the tape-feeding mechanism in position, the section being on the line 15 15 in Fig. 10. Fig. 16 is a similar view, but showing the parts in another position. Fig. 17 is a diagrammatic view of certain cams employed. Fig. 18 is a sectional front elevation showing the carriage and the feeding and controlling devices in one position. Fig. 19 is a similar view of the same, but showing the parts in another position. Fig. 20 shows a form of controlling-tape employed. Fig. 21 is an enlarged sectional plan view on the line 21 21 in Fig. 10 of the tape-feed, the carriage, and combs in normal position. Fig. 22 is a similar view of the same, but showing the parts in an actuating position. Fig. 23 shows a modified form of tape or web that may be employed under certain conditions. Fig. 23^a shows a table with the groups of elements representing the letters of the alphabet, punctuation-signs, and special keys used for forming the message on the tape or web. Fig. 24 is a sectional front elevation of a modified form of the mechanism adapted to be controlled by the tape shown in Fig. 23. Fig. 25 is a top view thereof with parts in section. Fig. 26 is a side view of the comb for the capital-key. Fig. 27 is a side view of one of the regular combs. Figs. 28, 29, 30, 31, 32, 33, 34, and 35 are plan views of the combs in various positions relatively to the tape, the latter being in section. Fig. 36 is a partial section and partial elevation of a tension device

employed. Fig. 37 is an elevation of the same at right angles to Fig. 36. Fig. 38 is a section on the line 38-38 in Fig. 36. Fig. 39 shows a modification in which certain parts are operated by pneumatic means. Fig. 40 is a section showing a valve for governing the pneumatic device, the said valve being in its closing position. Fig. 41 is a similar section, but showing the valve in position to permit the actuating of a type-writer or similar key; and Fig. 42 is a transverse section of a modified form of the improvement, showing an electromagnet arranged for operating certain parts.

Various attempts have heretofore been made to directly actuate the operating mechanism of type-machines of the class described by the use of a continuously-traveling tape or web having perforations representing the message or reading matter to be converted into type matter, the tape being for this purpose provided with perforations representing groups of single elements, of which each group represents a letter or character of the message. Now type-machines of this class are in themselves formed of a very complex mechanism, and in order to automatically and directly actuate this mechanism by the continuously-moving tape or web containing the elements of the message to be translated into type matter required the addition of such complex mechanism that the attempts heretofore made encountered almost insurmountable practical difficulties, and consequently reliable mechanism for accurate work could not be produced. In order to overcome these difficulties, I do not disturb the mechanism of the type-machine in question, but translate the elements on the tape into corresponding mechanical contrivances forming part of my machine, and each such mechanical contrivance in turn actuates a corresponding mechanical contrivance of the type-machine to produce accurate work.

In my machine the mechanical contrivance referred to may be in the form of levers 55, and I prefer hereinafter to call such contrivances "unitary parts," as each part represents a letter, numeral, punctuation-sign, logotype, or other unitary character or sign in contradistinction to the individual elements on the tape and of which elements it requires a number grouped together in a peculiar manner (see Fig. 23) to indicate or represent a letter, numeral, punctuation-sign, &c., of the message. For great accuracy in the result it is essential that the tape or web is not fed continuously, but intermittently, and is not used direct on the type-machine, but is employed to intermittently actuate the separate machine, which in turn by the unitary parts actuates the type-machine without interfering with the keyboard of such machine, so that this keyboard can be worked by hand whenever desired.

The improved machine is mounted on a suitable base A, carrying standards 2 for supporting a table or bed-plate 1, on which are

mounted to slide longitudinally assembling members, preferably in the form of combs 48, five in number, and controlled by a web or tape 13, fed intermittently by a feed mechanism B, located on a reciprocating carriage 9 for moving the tape to and from the combs 48 and actuating the same according to the message on the tape, as hereinafter more fully described, said combs controlling the unitary parts 55, which in turn are connected with the corresponding parts of a type-setting, linotype, or other machine. As shown in Figs. 1, 2, and 3, my improvement is applied to a type-writing machine C, set on a skeleton frame E, supported on posts D, carried by the base A.

The message on the tape is formed by groups of elements, of which each group represents a letter, numeral, punctuation-mark, or other character, sign-space, &c., (see Fig. 23^a), so that when a group of elements assembles the corresponding combs the corresponding unitary part has actuated such part representing the group of elements on the tape active at the time. The groups of elements are preferably arranged as shown in said Fig. 23^a, which illustrates the entire alphabet, some punctuation-signs, a group of elements for a space-key, a capital-key, one for a figure or numeral key, and one for a release-key. Each group of elements, as shown, contains five elements represented either by apertures or dashes or a combination of both. By having the elements in each group of a like number each letter or character or sign occupies the same space on the tape or web, and the intermittent feed given to the web or tape by the feed mechanism B corresponds to the length of the space occupied by a single group, so that the combs corresponding to the group active at the time are actuated for actuating the corresponding unitary part 55. Owing to the uniformity of the feed of the tape and the equal spaces occupied by the group of elements it is possible for the groups of elements to be placed one alongside the other without intervening spaces and without the slightest danger of actuating wrong combs.

The combs 48 are provided at the ends adjacent to the carriage 9 with pins or fingers 51, adapted to be engaged by a group of elementary apertures and dashes on the tape as the latter is moved bodily with the carriage to the right. When this takes place, the combs, with pins registering with apertures or perforations, are engaged by the latter and remain dormant, while the pins in register with the dashes are engaged by the solid parts of the tape and are shifted by the latter to the right to assemble such combs and bring their slots in register with each other for the corresponding unitary part 55 to drop in such registering slots. Thus, for instance, when the group of elements representing the letter "e" (see Fig. 23^a) and consisting of an aperture and four succeeding dashes engages the combs 48 four of the combs are shifted and

only one comb remains dormant as its pin or finger 51 passes through the solitary aperture in said group, while the four other combs are engaged by the solid portions of the web at the dashes following the aperture. In practice it is not necessary to show the dashes on the tape, and they may be omitted.

On the bed-plate 1 is a slideway 3, and from the said bed-plate depend hangers 4, in which is journaled a shaft 5, which may be rotated by any suitable means. I have here shown it as provided with a pinion 6 for engaging with a driving-gear 7, which is provided with a crank, so that it may be operated manually; but said shaft 5 may be driven from other suitable machinery by gearing or belt-and-pulley connections. Extended from one end of the bed-plate 1 is a guideway 8 for the reciprocating carriage 9 to slide on, said guideway consisting of plates secured to brackets 10, projected from the bed-plate 1. The inner edges of these bed-plates engage in grooves on each side of the carriage, so that while the carriage may reciprocate back and forth it is restrained from any other movement.

Mounted on the carriage 9 are perforated plates 11 and 12, between which the web or tape 13 is designed to pass, the perforations in the plates 11 and 12 being designed to act as guides for the passage through the tape-perforations of the fingers 51, extending from the controlling-combs 48, as previously mentioned. The plate 12 also acts as a support for the tape, while its solid portions, represented by dashes, are thrust against the corresponding fingers 51 of the said combs 48.

On the ends of the plates 12 are vertically-disposed rollers 14 and 15, and rearward of said plate 12 are guide-rollers 16 and 17. (See Figs. 10, 11, 12, 13, 14, 21, and 22.) These guide-rollers 16 and 17 are mounted, respectively, in brackets 18 and 19, held on a bar 20, adapted for adjustment transversely of the carriage, and for this purpose I employ set-screws 21 and 22, engaging tapped apertures formed in arms 23 24, extending from said bar 20, and the inner ends of these set-screws (see Fig. 12) impinge against the sides of the carriage. Obviously by manipulating these screws the rollers 16-17, and therefore the tape, may be adjusted. The object of providing for this adjustment of the guide-rollers 16 17 transversely of the carriage is to permit of minute adjustment of the tape or web, and which adjustment may be necessary to cause the elementary perforations to properly align with the fingers of the combs 48; but this adjustment once made rarely or never needs changing. A spring-guide 12^a is held on the carriage, straddles the plate 11, and serves to hold the tape or web against the face of the plate to prevent accidental shifting of the tape during the time the tape is active for shifting the combs.

Adjacent to the roller 16 and mounted on the sliding bar 20 is a curved shield-plate 25, (see Figs. 21 and 22,) designed to prevent

buckling of the web or tape as it passes along under the influence of the feeding mechanism. In other words, while the tape or web is being fed by the feeder or star-wheel 26 it will strike against the concave side of the shield-plate 25 and will be directed to a basket or other suitable receptacle without danger of its folding or returning upon the star-wheel. This star-wheel or feeder 26 has on its periphery a series of pins 27, (see Figs. 10, 18, and 19,) adapted to engage in perforations 28, formed in the tape 13, as shown in Fig. 20. The star-wheel 26 is mounted on a vertical shaft 29, adapted to rotate in the carriage 9, and on the lower end of said shaft 29 is a ratchet-wheel 30, designed to be engaged by a spring-pressed pawl 31, (see Figs. 15 and 16,) mounted on the bracket 10.

Reciprocating motion is imparted to the carriage 9 (see Figs. 5, 10, 18, and 19) by means of a cam-pulley 43, mounted on the driving-shaft 5, said cam-pulley having a peripheral groove engaged by a roller 44, loosely mounted on a stud 45, depending from said carriage. As the cam-pulley 43 moves the carriage 9 toward the bed-plate of the machine the ratchet-wheel 30 will of course be disengaged from the pawl 31; but upon the reverse movement of the carriage a tooth of the said ratchet-wheel will engage with said pawl 31, so that the star-wheel 26 will be rotated a sufficient distance to move the tape or web through one space. The star-wheel is held from backward rotation while the carriage is moving forward by means of a spring-pressed dog 46, mounted on the carriage and engaging with the ratchet-wheel. (See Figs. 15 and 16.) If it be desired to rotate the star-wheel backward for any purpose, the dog 46 may be disengaged from the ratchet-wheel by pushing outward upon the finger-piece 47, as indicated in dotted lines in Fig. 16.

The combs 48 are movable longitudinally on the slideway 3 and are held separately in a vertical position by means of pins 52, extended upward from the bottom of the slideway 3 and between adjacent combs, as is plainly indicated in Figs. 5, 21, and 22. Some or all of the combs 48 are shifted at a time to the right by the action of the tape moved bodily with the feed mechanism, and in order to insure a return movement of the combs to the left during part of the return stroke of the carriage I provide the under side of each finger 51 with a lug 95, adapted to be engaged by a spring arm or finger 94, mounted on a block adjustably secured to the carriage 9, so that when the latter is on the return or outward movement the arms or fingers 94 engage the lugs 95 of the previously-shifted combs to return the latter to their normal position. (Shown in Figs. 10 and 21.)

The several combs 48 are provided in their top edges with slots variously placed, (see Fig. 27,) and the slots are designed to govern the unitary parts in the form of levers 55, mounted to swing independently of each other

on a rod 53, secured in standards 54 on the bed-plate 1, said unitary parts or levers 55 being mounted to swing in fixed guideways 55^a to restrain the parts from sidewise motion. The number of unitary parts or levers 55 will correspond to the number of unitary parts contained in the machine to which my device is applied, and said unitary parts 55 are designed to have connection by means of 10 cords or other devices with the several keys of such type-machine. The unitary parts or levers 55 extend transversely of the combs 48 and are supported at their ends normally above the several combs by means of a supporting-bar 56, and they are held yieldingly 15 against said supporting-bar and are adapted to swing downward at the proper time by means of springs 57, connected at one end to the levers 55 and at the other end to a cross-bar 58, supported on a threaded standard 58^a, 20 so that the tension of the springs 57 may be adjusted by nuts 58^b. (See Figs. 6, 7, and 8.) The ends of the supporting-bar 56 are movable in slots formed in standards 59, and said 25 bar is moved upward by means of posts 65, mounted on the outer ends of two levers 60, rocking on shafts 61, and said levers 60 are provided at their inner ends with rollers 62, engaging with cams 63, attached to the shaft 30 5. (See Fig. 5.) As a means of adjusting the bar 56 vertically I provide step-bearings 64, adjustable through the levers 60, and these bearings are preferably made in the form of screw-bolts, which in their upper ends have 35 depressions for receiving the lower pointed ends of the posts 65, depending from the bar 56.

Forward of the supporting-bar 56 and also forward of the unitary parts or levers 55 is a 40 striking-bar 66, mounted on the upper ends of arms 67, projecting upward from a rock-shaft 68. On the latter is arranged an inwardly-extending arm 69, carrying at its free end a roller 70, engaging the peripheral surface of a cam 71, mounted on the shaft 5 between the cams 62 and 63. A spring 72, connected at one end to the supporting-bar 56 45 and at the other end to the arm 69, serves two purposes—one to depress the bar 56 and the other to hold the roller 70 in contact with the cam 71. 50

Mounted to slide on each key-lever 55 is a tappet-rod 73, (see Figs. 7 and 8,) movable through guideways 74 on the unitary part or 55 lever 55, and the outer end of said tappet-rod extends normally forward of the end of the lever to which it is attached. A stop 75 on the inner end of the tappet-rod engages against each side of the lever 55, and said 60 stops not only prevent the tappet-rods from rotating in their bearings, but also by coming in contact with the inner bearing 74 prevent the tappet-rods from moving too far in an outward direction. From the inner end 65 of the tappet-rods 73 extend cords or other suitable connections 76 around idler-pulleys 77, mounted on a rod supported in hangers

78, said cords then extending around idler-pulleys 79, supported in hangers 80, and from these idler-pulleys 79 the cords extend to connect with the keys of the type-machine to be 70 operated. Provision is made for adjusting the length of the cords by turnbuckles or other well-known mechanical means.

Alongside the combs 48 and similarly 75 mounted are arranged a figure-comb 49 and a capital-comb 50, having slots or notches in their top edges, but without fingers 51. (See Figs. 4, 5, 21, 22, 26, 28, 29, and 30.) The figure-comb 49 and the capital-comb 50 are 80 adapted to be actuated by levers 82 and 81, respectively, located at one side of the unitary parts or levers 55 (see Fig. 4) and likewise fulcrumed on the rod 53. The lever 81 (see Fig. 26) has a wedge-like cam 88 on one 85 side to engage with the inclined surface 89, formed on the capital-comb 50, and a similar cam 90 is formed on the lever 82 to engage with an inclined surface 91 on the figure-comb 49, so that when either of these levers 90 swings downward the corresponding comb will be moved into an operative position.

At the opposite side of the series of unitary parts or levers 55 and likewise fulcrumed on the rod 53 is arranged a release-lever 92, 95 (see Figs. 4 and 26,) having cam-surfaces 93 adapted to engage with the inclined surfaces 93^a on both the combs 49 and 50, so that when the lever 92 swings downward it will return either or both of these combs to their normal 100 position—that is, the lever 92 will be brought into operation when it is desired to change from capitals or figures back to lower case at the time the corresponding group of elements (see Fig. 23^a) is active on the tape and shifts 105 the corresponding combs 48 to such position as to allow the lever 92 to swing downward the same as a unitary part or lever 55. The three levers 81, 82, and 92 are supported at their free ends on the supporting-bar 56 in a 110 similar manner to the levers 55, and they each have spring connections with the bar 58, the three springs supplying the power to shift the combs 49 or 50 in the manner described. 115

The tape 13 is fed from a roll supported in any suitable manner, and preferably it will pass through a tension device (see Figs. 3, 4, 36, 37, and 38) before it reaches the star-wheel 26, so as to keep said web or tape under proper stress. The tension device is provided with a roller 32, supported on a stem 33, extending from a base 34, attached to the main base A, and said roller 32 is prevented from revolving freely on the stem 33 by a 120 spring 35, which surrounds the stem and engages at one end with the roller 32 and at the other end with a sleeve 36, mounted loosely on the stem 33. The tension of the spring 35 may be adjusted by means of clamping-jaws 125 37 and 38, which engage the periphery of the sleeve 36, and said jaws 37 38 are connected at one end to the base 34, and at the opposite ends they are connected to each other by an

adjusting-bolt 39. By the operator manipulating the nut on the bolt 39 the jaws 37 and 38 may be caused to bear with greater or less friction upon the sleeve 36, and the tension of the spring 35 will be regulated accordingly. The web or tape is held against the roller 32 by means of a presser-roller 40, mounted on a rod 41, having swinging connection with the base 34, and said roller 40 is yieldingly held toward the roller 32 by means of a spring 42, attached to one end of the base or to any other fixed device and bearing at its free end against the rod 41, as plainly indicated in Fig. 6.

The operation is as follows: When the several parts are in the position shown in Figs. 1, 2, 4, 5, 6, 10, and 21, then the several unitary parts or levers 55 are supported in their uppermost position, directly above the combs 48, 49, and 50, by the supporting-bar 56, the outer ends of the fingers 51 of the combs 48 being transversely in alinement with each other in the guide-plate 11. The web or tape 13 extends between the plates 11 and 12 and passes around the feed or star wheel 26, as shown in Fig. 21, the feed-carriage standing at this time in its outermost position at the extreme left, the friction-roller 44 being in the groove of the cam 43 at the line $x x$. (Shown in Fig. 17.) Now when a rotary motion is given to the shaft 5 the cam 43 causes the carriage 9 and the now active feed mechanism B, the tape portion directly engaged by said feed mechanism, and the guide-plates 11 and 12 to move to the right, so that the tape is brought to the free aligned ends of the fingers 51, with the elements of a group on the tape in register with the said free outer ends of the fingers 51. Upon a further motion to the right of the carriage and the parts carried thereby the solid or dash elementary portions of the web or tape shift the corresponding fingers and their combs 48 to the left, while the fingers opposite the perforations or apertures on the tape pass through the latter and remain dormant—that is, their combs are not shifted to the right, but remain stationary. When the carriage is in its extreme right-hand position, the combs 48 are assembled in such a manner that one set of slots or notches of all the combs are in register with each other in a transverse direction directly under that unitary part or lever 55 which represents the group of elements on the tape active at the time on the fingers 51 of the combs. When this takes place, the cams 63 actuate the levers 60 to move the supporting-bar 56 downward and allow the unitary parts or levers 55 to rest on the top of the combs 48, 49, and 50, with the exception of that unitary part or lever 55 now in register with the registering slots of the combs, and which single lever now swings downward by its own weight, assisted by the spring 57, the lever following the retreating or downward movement of the supporting-bar 56. (See Fig. 7.) When this has taken place, the cam 71 actuates the striker-

bar 66 to impart a sliding motion to the tapet-rod 73, (see Fig. 8.) whereby the unitary part or key of the type-machine is actuated to produce type or other matter corresponding to the letter, sign, character, or the like and represented by the active group of elements on the tape or web and in engagement at the time with the fingers 51, as above described. The next action is the return of the supporting-bar 56 and the striker-bar 66 by the action of the cams 63 and 71 on the levers 60 and arm 69, respectively, so that the down lever 55 is first swung upward out of the registering slots or notches of the combs and again into alinement with the other non-active levers or unitary parts 55 to finally swing all the levers 55 upward back to their former normal position—that is, directly above the top edges of the combs—to allow free longitudinal movement of the combs when shifted by the solid tape portions, as above described. Upon the return movement of the carriage the previously-shifted combs are moved back to their former positions by the spring-fingers 94, moving with the carriage and engaging lugs 95 on the fingers 51, as previously explained. The feed mechanism for the tape is actuated immediately after the tape leaves the outer ends of these fingers 51, engaging apertures in the tape and belonging to those combs which remain dormant for the time being, as described. As the described movement of the actuated parts depends mainly on the construction and arrangement of the cams 43, 63, and 71, it is deemed advisable to more fully describe their action, special reference being had to Fig. 17. The carriage 9 is in an outermost position at the time the roller 44 stands in the groove at the line $x x$, and when the cam is rotated and the friction-roller travels from the line $x x$ to the line 18 18 then the carriage moves rapidly inward to bring the tape 13 in contact with the outer ends of the fingers 51, and when the friction-roller travels in the cam-groove on the line 18 18 to the line 19 19 a distance about one-third of the circumference of the cam then a very slow feed to the right is given to the carriage and its tape to shift the corresponding dash-combs to the right and assemble the combs, as described. This slow gradual feed prevents the fingers in contact with the solid portions of the web or tape from piercing, tearing, or otherwise injuring the tape or web, as might be the case if a fast motion is given to the carriage during the period of shifting the combs. During this time—that is, while the roller 44 travels from the line $x x$ to the line 19 19—the friction-rollers 62 and 70 travel on the segmental cam-surfaces of the cams 63 and 71, respectively, and consequently the levers 60 and arms 69 remain dormant; but when the carriage begins its return stroke after the friction-roller leaves the line 19 19 then the drop in the cam causes the levers 60 to be actuated for dropping the supporting-bar 56 from under the combs and allowing a corresponding unitary part or le-

ver 55 to drop into the registering slots or notches of the combs 48. When this has taken place, the cam 71 actuates the striker 67 to act on the tappet-rod 73 and actuate the
 5 corresponding unitary part of the type-machine, as above explained. Both cams now allow the levers 60 for the supporting-bar 56 and the arms 69 and 67 for the striker 66 to return to their former positions, so that the
 10 supporting-bar 56 is again raised to swing the previously-dropped unitary part into alinement with the rest of the unitary parts and to then swing all of the latter just free of the combs, so as not to interfere with their sliding
 15 motion for assembling, as previously explained. During the action of the cams 63 and 71 and during the first part of the return movement of the carriage the tape is carried back out of contact with all the fingers. As
 20 soon as the tape is free from the fingers the star-wheel 26 is rotated by the action of the pawl 31, as previously explained, the feeding stopping at the time the carriage has completed its return stroke—that is, when the
 25 roller 44 is again at the line *xx* of the cam. During the latter portion of the return movement of the carriage the fingers 94 engage the projecting lugs 95 and carry the combs previously actuated by the solid or dash parts
 30 of the tape back to their former positions to bring the outer ends of all the fingers again in alinement with each other to be ready for the next action.

From the foregoing general description of
 35 the operation of the machine it will be readily understood that according to the message on the tape one, two, or more, all or none of the combs is shifted at a time, as will appear by reference to the table shown in Fig. 23^a. Now
 40 to more clearly illustrate the detail working of the machine it is assumed that the tape portion shown in Fig. 20 is intermittently fed through the machine.

Referring particularly to Fig. 20, the first
 45 tape portion *a* is entirely unperforated and corresponds to the five dashes for the space-key, as shown in Fig. 23^a. Now when the carriage is moved toward the bed-plate and the tape portion *a* is pressed against the fingers all of the combs 48 will be simultaneously
 50 moved. The next portion *b* contains first a blank or dash, then a perforation, and then follow three more blanks or dashes. The sign within the portion *b* (which is designed to
 55 make the machine operate capital letters) will permit the finger 51 of the second comb 48 from the front of the series to enter the perforation, so that no motion will be imparted to the second comb when the carriage is moved
 60 toward the bed-plate; but the several other combs 48 will be moved to their limit and also in alinement with a slot in the capital-comb 50 and in the figure-comb 49. The next portion contains a sign which represents the
 65 small letter "b"—that is, has within the portion a perforation, then two blanks or dashes, and then two perforations. This small "b"

sign will allow the operation of the capital "B," because the previous sign has thrown the capital-comb into operative position. 70
 When the portion of the tape having this sign is moved by the carriage toward the bed-plate and against the ends of the fingers 51, the first one and the last two of the combs 48 will remain stationary, because their fingers will
 75 pass through the perforations. The other two combs, however, will be moved to their limit. This puts the proper series of slots in alinement to allow a lever 55 to drop downward and actuate the capital "B" key of the type-
 80 writer or other machine, and this is carried on as long as the capital letters are required. Thus the word "BOURKE" is produced in type matter. When it is desired to change
 85 the machine to its normal condition of operating small letters, a release-sign (indicated in the portion *c* in Fig. 20) is provided. This sign adjusts the combs so that the release-lever 92 is permitted to drop and throw the capital-comb back to normal position. 90

In Figs. 27 to 35, inclusive, I have diagrammatically shown the position of the several combs to allow for the printing of the small letter "a," a capital "A," and a figure, and referring thereto Fig. 28 indicates the
 95 normal position of the several combs. Now as the sign for the small letter "a" reaches its position on the plate 12 and as the carriage is moved toward the bed-plate the combs will be distributed to the position indicated
 100 in Fig. 29—that is, the slots of the combs will be in alinement to permit a lever 55 to be drawn downward to operate the device for the small letter "a." Upon the return movement of the carriage the several combs 48 will
 105 be returned to their normal position. (Indicated in Fig. 28.) In order to set the combs in position to allow for the printing of capitals, the capital-sign will come into position to permit the adjustment of the combs and
 110 allow the lever 81 to move downward into the alined slots of the several combs 48 and the comb 49, and the downward movement of this lever 81 by engaging its cam-surface with the incline 89 will move the capital-
 115 comb 50 from the position indicated in Fig. 30 to the position indicated in Fig. 31. The next stage is the return of all the combs except the capital-comb to the position shown in Fig. 32. After this when the sign for the
 120 small letter "a" moves forward the fingers 51 of the first two combs 48 will pass through perforations, so that these two combs will remain idle. The other three combs, however, will be forced to the right to bring certain
 125 slots in alinement with a slot in the comb 50 and also in line with a slot in the comb 49. Then the proper lever 55 may be moved downward by its spring to operate a printing-type; but none of the other levers can be moved
 130 downward, because there are no alined slots to receive them. At this time the parts will be in the position indicated in Fig. 33. Then after the printing shall have taken place or

the proper type is released the parts will be returned to the position indicated in Fig. 32. Then as the release-signal reaches its position the proper slots will be put in alinement to allow the lever 92 to move downward, as shown in Fig. 34. This lever will return the comb 50 to its normal position, and then the several parts will be returned to the position indicated in Fig. 28 by means of the fingers 94. For operating figures when the proper sign reaches its position—say the sign for the figure “3”—the comb 49 will be moved by means of the lever 82 to the position indicated in Fig. 35, bringing the proper slots in alinement to allow of the drawing downward of the proper lever for operating the type carrying the figure “3.”

In certain figures of the drawings heretofore described I have shown the machine in connection with a type-writer. In Fig. 9 I have shown the same machine as attached to a linotype-machine, and in this view the machine is turned so that the several levers 55 extend vertically instead of horizontally, and from the tappet-fingers 73 there are direct connections 96 with the key-levers 97 of the linotype-machine. In Fig. 23 I have shown the tape or web 98, which performs the same function as the tape first described; but in this tape 98 the signs are arranged transversely of the tape or web. By this means the same number of words or characters may be formed in a shorter space than can be formed on the tape first described, where the signs extend lengthwise of the tape; but this form of tape cannot be conveniently telegraphed like that in which the signs are disposed lengthwise of the tape. When this tape 98 is employed, the machine will be arranged as indicated in Figs. 24 and 25, in which it may be noted that the plate 12 is omitted, and as a substitute therefor I provide a star-wheel 99, having perforations through which the projections or fingers 51 may pass when the carriage is moved toward the bed-plate. The tape or web 98 passes around the star-wheel 99 and also engages against idlers 100 and 101. A pawl 102, mounted on a fixed support 103, is designed to engage with a ratchet-wheel 104 on the shaft of the wheel 99 to impart a rotary motion to said wheel upon the return movement of the carriage on which the wheel is mounted. Mounted on the carriage forward of the wheel 99 is a plate 105, provided with perforations for receiving and guiding the fingers 51 of the combs 48. The operation of this device is substantially the same as that first described.

In the modification shown in Fig. 39 the key-levers of the type-writer are operated by pneumatic agency under the control of the several levers 55. Each lever 55 is movable vertically in a slot formed in a block 106 on the forward portion of the bed-plate 1. Extended longitudinally in the block 106 is an opening 107, which forms an air-chamber

which has communication through a pipe 108 with a pump 109, the piston of which is operated by an eccentric 110 on the shaft 5. At one side of the slot in each block 106 a port 111 is formed, the said port communicating with the air-chamber 107 and also having an outward opening which is normally closed by the lever 55, as indicated in Fig. 40. At the other side the block is provided with a port 112, from which a pipe 113 extends to a cylinder 114, in which a piston 115 operates, the said piston having connection with the key-lever of the type-writer. Of course there will be an operating-piston 115 for each of the key-levers. When the several levers 55 are in their upper or normal position, they serve as valves to close the outlets of the ports 111. When one of the levers is drawn downward, however, a hole 116 in said lever will place the ports 111 and 112 in communication, so that the blast of air from the pump 109 will be forced through the pipe 113, controlled by said downwardly-moved lever, and upon the upper side of the piston 115, causing the type-writer or other machine to be drawn downward to operate a type.

In the modification shown in Fig. 42 the unitary parts or levers 55 are held in their normal uppermost position above the combs 48 49 50 by a support 120, controlled by a cam 121 on the main shaft 5, having means 122 for closing an electric current to actuate an electromagnet 123, which is located under the unitary parts 55 and which latter are now armature-levers. The electromagnet is actuated after the combs are shifted by the tape and the support 120 has moved into a lowermost position, so that the unitary part 55 in alinement with the registering slots in the combs is now forced to swing downward by being attracted by the electromagnet. The unitary part 55 is directly connected by the cord 76 with the corresponding part of the type-machine, and the striker mechanism previously described is in this case dispensed with, as the force of the electromagnet is sufficient to actuate the unitary part or lever 55 and the type-machine. A tape of any width or material may be used; but preferably I employ ordinary telegraphic paper tape of the standard half-inch width. As perforations in place of writing characters are used, it is not necessary that the paper shall be white—in fact, ordinary brown paper may be used—and it is not material as to the thickness of the paper, as I have found by experiment that even tissue-paper will move the combs to their appropriate positions.

In the modification in which the signs are placed transversely of the tape (see Fig. 23) the tape may advantageously be made wider than the standard telegraphic tape, and in this construction it is well to provide two rows of perforations to receive similar rows of teeth on the star-wheel. This arrangement of feed-holes may also be employed in the tape shown in Fig. 20, with the signs ar-

ranged between the two lines of perforations and lengthwise of the tape. In Fig. 20, however, a single line of feeding-holes 28 is shown as arranged in the center of the tape with the signs at one side; but it is obvious that signs may be placed at both sides of the feeding-holes.

While five elements are shown as comprised in each group, it is evident that a greater number may be used. If five elements are used in each group, a capital and figure comb will be required in the machine. In the event of six elements being used in each group there will be sixty-four possible combinations of the elements, and hence only one, either a capital or a figure, comb will be required, and if each group is composed of seven elements one hundred and twenty-eight combinations are possible, and in such case it is manifest that no capital or figure comb will be required. This last arrangement is especially applicable to the modification shown in Fig. 23, which, it is obvious, cannot be readily telegraphed like the tape shown in Fig. 20, but may be preferable for matter not to be transmitted by telegraph or otherwise what may be termed "local" matter.

Having thus fully described my invention, I claim as new and desire to secure by Letters Patent—

1. The combination, with the actuating mechanism of a type-writing, type-setting, type-casting or other machine for the dissemination of intelligence, of a tape representing a message and having perforated and non-perforated portions, and a machine connected with the said actuating mechanism for transmitting its motion to the said mechanism of the type-machine, the said machine being positively actuated by the non-perforated portions of the said tape.

2. The combination, with a tape having lengthwise and sidewise movement and having perforated and non-perforated portions representing a message, of a machine connected with the actuating mechanism of a type-writing, type-setting, type-casting or other machine for the dissemination of intelligence the said machine having assembling devices adapted to be engaged by the said non-perforated portions of the tape to bodily shift the assembling devices to be actuated for a particular letter, character, sign and the like of the message, the remaining assembling devices remaining dormant by being accommodated by the perforated portions.

3. The combination, with a tape having lengthwise and sidewise movement and having perforated and non-perforated portions representing a message, of a machine connected with the actuating mechanism of a type-writing, type-setting, type-casting or other machine for the dissemination of intelligence, the said machine having assembling devices to be engaged by the said non-perforated portions of the tape to bodily shift the assembling

devices to be actuated for a particular letter, character, sign and the like of the message the remaining assembling devices remaining dormant by being accommodated by the perforated portions, and means for first moving the said web lengthwise to position for a particular letter, character, sign and the like of the message, and then moving it sidewise for actuating the assembling devices.

4. In combination, a machine for governing the actuating mechanism of a type-writing, type-setting, type-casting or similar contrivance, and an actuating and controlling device for said machine, the machine having a plurality of governing members movable relatively to each other to effect various operative assemblages of said members, the actuating and controlling device consisting of a tape having perforated and non-perforated portions, the non-perforated portions engaging sundry of the members and serving directly to effect an operative assemblage of the moved and unmoved members.

5. The combination with a machine for the dissemination of intelligence, of a tape or web containing elements representing alphabetic or other characters, and a machine positively actuated and controlled by said tape according to said elements and arranged to translate the elements of the tape into unitary parts representing letters of the alphabet and other characters, said unitary parts being directly connected with the corresponding unitary parts of the type-machine, substantially as shown and described.

6. The combination with a linotype or other machine for the dissemination of intelligence, of a tape or web having groups of elements, the elements in a group representing an alphabetic or other character, and said groups being arranged one alongside the other, an intermittent feed mechanism for said tape or web, to feed the latter successively the distance of a group of elements, means for moving the tape sidewise, and mechanism controlled by said tape or web and having unitary parts connected with the corresponding parts of the said type-machine, the unitary parts being controlled by said tape elements during the sidewise movements of the tape, substantially as shown and described.

7. The combination with a linotype or other machine for the dissemination of intelligence, of a tape or web having perforations arranged in a longitudinal line and each representing an element of an alphabetic or other character, the perforations being in groups, each group representing a letter or other character and the groups being located one alongside the other without intermediate spaces, a mechanism having an intermittent feed for the said tape and moving the latter sidewise and unitary parts connected with corresponding parts of the type-machine, and means for actuating a corresponding unitary part from the tape, according to the corresponding group of per-

forations during the sidewise movement of the tape; substantially as shown and described.

8. In a machine for use with a type-setting, type-casting or other machine for the dissemination of intelligence the combination with a tape or web having groups of elements, each group representing a letter or other character, of a mechanism for moving the tape lengthwise, a series of combs in engagement with the tape and controlled by said elements, and a series of unitary devices each controlled by one or a plurality of said combs, substantially as shown and described.

9. The combination with the actuating mechanism of a type-writing, type-setting, type-casting or other machine for the dissemination of intelligence, of a tape representing a message and having alternate lengthwise and sidewise movement and having perforated and non-perforated portions, and a machine connected with said actuating mechanism, for transmitting its motion to the said mechanism of the type-machine, the said machine being positively actuated by the non-perforated portions of the said tape during the sidewise movement thereof.

10. The combination with the actuating mechanism of a type-writing, type-setting, type-casting or other machine for the dissemination of intelligence, of a tape representing a message having perforated and non-perforated portions, a mechanism for intermittently feeding the tape lengthwise and moving it sidewise during the period of rest after a lengthwise movement, and a machine connected with said actuating mechanism, for transmitting its motion to the said mechanism of the type-machine, the said machine having assembling devices actuated by or during the sidewise movement of said tape, substantially as shown and described.

11. In an actuating mechanism for key-operated machines, a series of movable combs, devices controlled by said combs for controlling the action of a key-operated machine, and a movable web for causing an assembling of the combs and having lengthwise and sidewise movement, substantially as shown and described.

12. In an actuating mechanism for key-operated machines, a series of combs, devices controlled by said combs for controlling the action of a key-operated machine, a perforated web for assembling the combs, means for moving said web lengthwise, and means for moving the web sidewise toward or from the combs, substantially as shown and described.

13. In an actuating mechanism for key-operated machines, a series of combs, devices controlled by said combs for controlling the action of a key-operated machine, a perforated web, means for imparting an intermittent feeding motion to said web, and means for moving the web sidewise to assemble the combs, substantially as shown and described.

14. In an actuating mechanism for key-op-

erated machines, a series of combs mounted to slide, devices controlled by said combs for controlling the action of a key-operated machine, a perforated comb-controlling web, a feeding device for the web to feed the latter lengthwise, means for imparting intermittent motion to the feeding device, a carriage on which the feeding device is mounted to move the web sidewise, and means for imparting reciprocating motion to the carriage, substantially as shown and described.

15. In an actuating mechanism for key-operated machines, a series of combs mounted to slide, devices controlled by said combs for controlling the action of a key-actuated machine, a carriage mounted to slide at one end of the combs, a feeding-wheel mounted on said carriage and having projections on its periphery, a perforated web having holes to receive the projections on the feeding-wheel, the latter feeding the web lengthwise and the web moving sidewise with said carriage, means for operating the carriage to cause the web to adjust the combs, a ratchet-wheel on the shaft of the feeding-wheel, and a dog for engaging with said ratchet-wheel to rotate the feeding-wheel, substantially as shown and described.

16. In an actuating mechanism for key-operated machines, a series of combs mounted to slide, levers extended across said combs and adapted to enter slots in the combs when the slots in the several combs are in alignment, tappets movable on said levers and adapted for connection with keys of a key-actuated machine, a striker for moving the tappets in one direction, means for operating the striker, a perforated web for assembling the combs, and means for moving said web, substantially as shown and described.

17. In a mechanism for operating key-actuated machines, a series of combs mounted to slide, a perforated web for assembling said combs, means for operating the web, levers extended across the combs and adapted to enter aligned slots in the combs, a support-bar for holding the levers normally out of engagement with the combs, means for moving said bar, tappet-rods movable on the levers and having their forward ends extended beyond the ends of the lever, the said tappet-bars being adapted for connection with the keys of a key-operated machine, a striker-bar for moving the tappet-rods in one direction, and means for imparting a swinging motion to said striker-bar, substantially as shown and described.

18. In an actuating mechanism for key-operated machines, a bed-plate, a series of combs mounted to slide on said bed-plate, certain of said combs having fingers or projections at one end, devices controlled by the combs for controlling the action of a key-operated machine, a reciprocating carriage adapted to receive a web having perforations to receive certain of the fingers or projections and also being adapted to engage with certain other

fingers or projections to move the combs thereof, and means carried by the carriage for returning all of the combs to a normal position upon a backward movement of the carriage, substantially as shown and described.

19. In an actuating mechanism for key-operated machines, a bed-plate, a series of combs mounted to slide on said bed-plate, means controlled by said combs for controlling the action of a key-operated machine, certain of said combs having fingers or projections at one end, a carriage mounted to reciprocate at the end of the combs in the direction of the length of the combs, a feeding device on said carriage, a perforated web moved intermittently lengthwise by the said feeding device and sidewise by the said carriage for assembling the combs, lugs on the fingers or projections of the combs, and spring-arms on the carriage adapted to engage with said lugs to adjust the combs to a normal position, substantially as shown and described.

20. In an actuating mechanism for key-operated machines, a series of combs, devices controlled by said combs for controlling the action of a key-operated machine, a reciprocating carriage arranged at one end of the combs, means for causing the movements of the carriage, a web carried by said carriage and adapted to adjust the combs, levers extending across the series of combs and each being adapted for connection with a key of a key-actuated machine, means for drawing the levers into slots of the combs when said slots are in alignment, means for moving the several levers out of engagement with the combs, and perforated plates on the carriage between which the web or tape is designed to pass, substantially as shown and described.

21. In an actuating mechanism for key-operated machines, a series of combs mounted to slide, a carriage mounted on one end of the machine, a perforated web mounted to move across said carriage and to be carried by said carriage to assemble the combs, a driving-shaft, a cam on said shaft and having engagement with the carriage to move the same in two directions, levers extended across the combs, tappet-rods movable longitudinally on said levers, the said tappet-rods being adapted for connection with the keys of a key-actuated machine, a striker-bar for engaging with and operating said tappet-rods, a cam on the driving-shaft for imparting a striking motion to said striker-bar, and means controlled from the driving-shaft for elevating the levers and also for permitting downward movement of the levers, substantially as shown and described.

22. In an actuating mechanism for key-operated machines, a series of combs mounted to slide, means for causing adjustments of said combs, levers extended transversely of the combs, tappet-rods movable upon the levers and adapted for connection with the keys of a key-operated machine, a support-bar common to all the levers, means for raising and

lowering said bar, a striker-bar for engaging with the tappet-rods, and means for operating said striker-bar, substantially as shown and described.

23. In an actuating mechanism for key-operated machines, a series of combs mounted to slide, devices controlled by said combs for controlling the action of a key-operated machine, a carriage mounted to reciprocate, means for imparting motion to the carriage, a tape or web feeding wheel on the carriage, means for imparting motion to said wheel, guides forward of the wheel and adjustable transversely of the carriage, and perforated plates on the carriage forward of said guides, substantially as shown and described.

24. In an actuating mechanism for key-operated machines, a series of combs mounted to slide, devices controlled by said combs for controlling the action of a key-operated machine, a carriage mounted to slide at one end of the combs, a web-carrying wheel mounted on said carriage, means for imparting intermittent rotary motion to the wheel, guide-rollers on the carriage forward of the wheel, the said guide-rollers being mounted on a bar adjustable transversely of the carriage, a curved shield-plate adjacent to one of the said rollers, and perforated plates on the carriage between which a perforated web for adjusting the combs is designed to pass, the said web being moved lengthwise by the feeding-wheel, substantially as shown and described.

25. In an actuating mechanism for key-operated machines, a series of combs, devices controlled by said combs for controlling the action of a key-operated machine, a carriage arranged to have reciprocating motion at one end of the combs, a star or feeder wheel mounted on the carriage, a ratchet-wheel on the shaft of said star or feeder wheel, a pawl mounted on a fixed support and adapted for engagement with said ratchet-wheel to rotate the star or feeder wheel, perforated plates on the carriage and between which a perforated web for assembling the combs is designed to pass and moved by the star or feeder wheel, rollers mounted on the ends of one of said plates, and guide-rollers on the carriage between the first-named rollers and the star or feeder wheel, substantially as shown and described.

26. In an actuating mechanism for key-operated machines, a series of combs mounted to slide, means controlled by said combs for controlling the action of a key-operated machine, a carriage movable at one end of the combs, a perforated web movable through said carriage lengthwise and moving sidewise with the carriage to adjust the combs, means for feeding said web through the carriage, a tension device for the web, and devices controlled by the combs for controlling the action of a key-operated machine, substantially as shown and described.

27. In an actuating mechanism for key-operated machines, a series of combs mounted

to slide, devices controlled by said combs for controlling the action of a key-operated machine, means for causing adjustments of the combs, a capital slide or comb at one side of the first-named series of combs, a figure slide or comb at the other side of the said series of first-named combs, a lever extended across the combs and having a cam for moving the capital-comb in one direction, a lever extended across the combs and having a cam for engaging with and moving the figure-comb in one direction, and another lever having cams for engaging with and moving the capital-comb and figure-comb to normal position, substantially as shown and described.

28. An actuating mechanism for key-operated machines provided with a series of combs, a tape for moving the said combs, a change-comb, and means controlled by the said series of combs to actuate the said change-comb for changing the combination from small letters to capitals or to numerals, substantially as shown and described.

29. In an actuating mechanism for key-operated machines, a series of combs mounted to slide, a carriage movable at one end by said combs, a web-feeding wheel mounted on said carriage and adapted to operate a web for causing adjustments of the combs, a ratchet-wheel on the shaft of said feeding-wheel, a pawl on a fixed support for engaging with said ratchet-wheel, a spring-pressed dog carried by the carriage and adapted for engagement with said ratchet-wheel, to prevent a backward movement of the feeding-wheel while the carriage is moving forward, and a

finger-piece extended from said dog, substantially as shown and described.

30. In a machine of the character described, a tension device for a web-fed through the machine, said tension device comprising a roller, a stem on which said roller is mounted, a sleeve on the stem, a spring surrounding the stem and connected at one end with said sleeve and at the other end with the roller, a tension device engaging with said sleeve, a presser-roller, and means for holding said presser-roller yieldingly toward the first-named roller, substantially as shown and described.

31. An actuating mechanism for key-operated machines, provided with a series of combs, a tape for moving the said combs, a capital-comb, a numeral-comb, and means controlled by the said series of combs for actuating the said capital-comb or the numeral-comb, substantially as shown and described.

32. An actuating mechanism for key-operated machines, provided with a series of combs, a tape for moving the said combs, a capital-comb, a numeral-comb, and a release-lever controlled by the said series of combs, to return either or both the capital-comb and the numeral-comb back to a normal position to change the combination from capitals or numerals back to lower case, substantially as shown and described.

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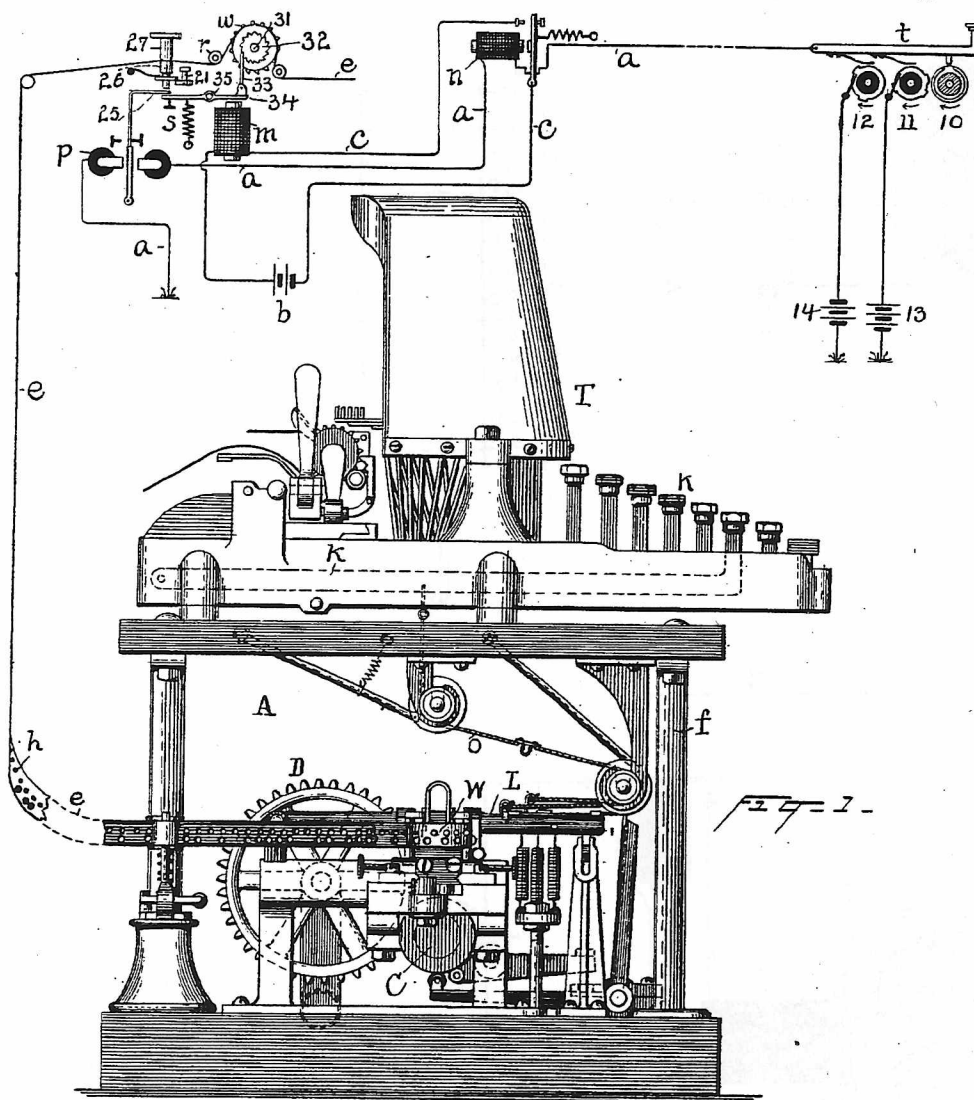
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D. MURRAY.
PAGE PRINTING TELEGRAPH.

(Application filed Nov. 28, 1899.)

(No Model.)

9 Sheets—Sheet 1.



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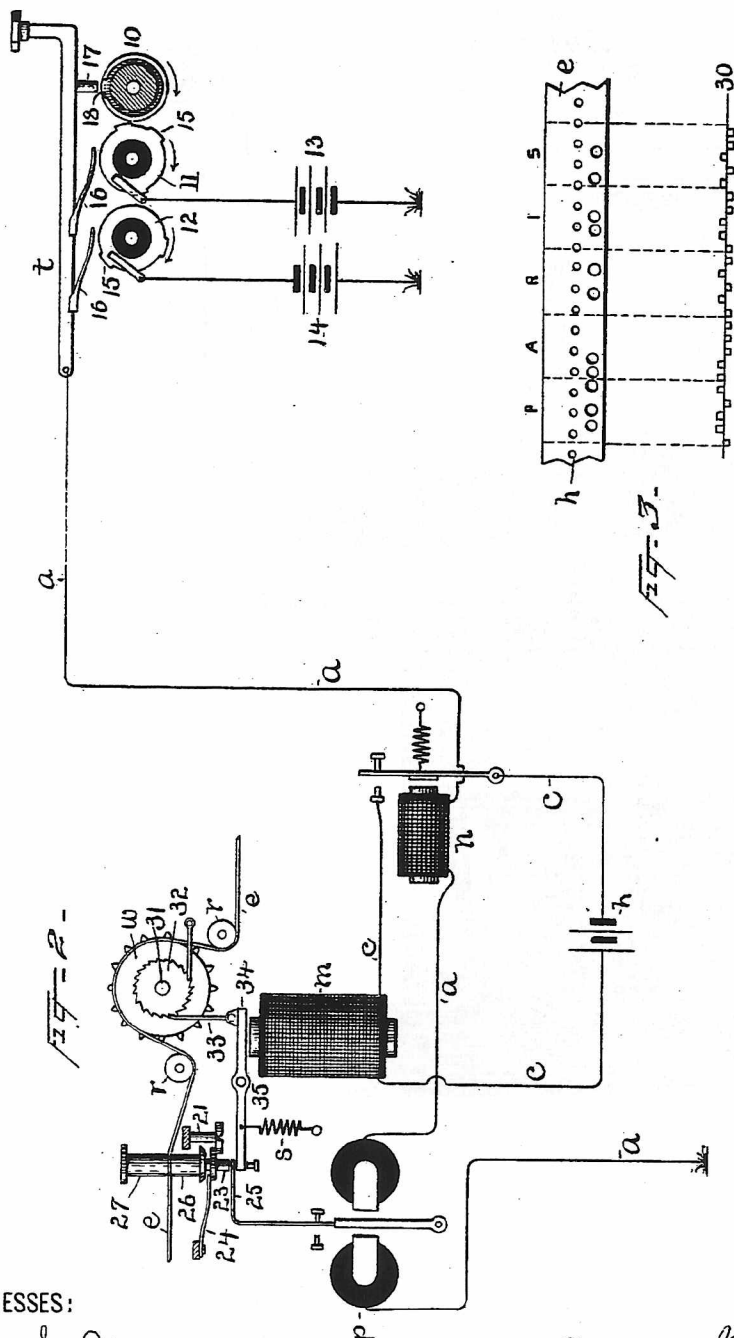
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D. MURRAY.
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(Application filed Nov. 28, 1899.)

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9 Sheets—Sheet 2.



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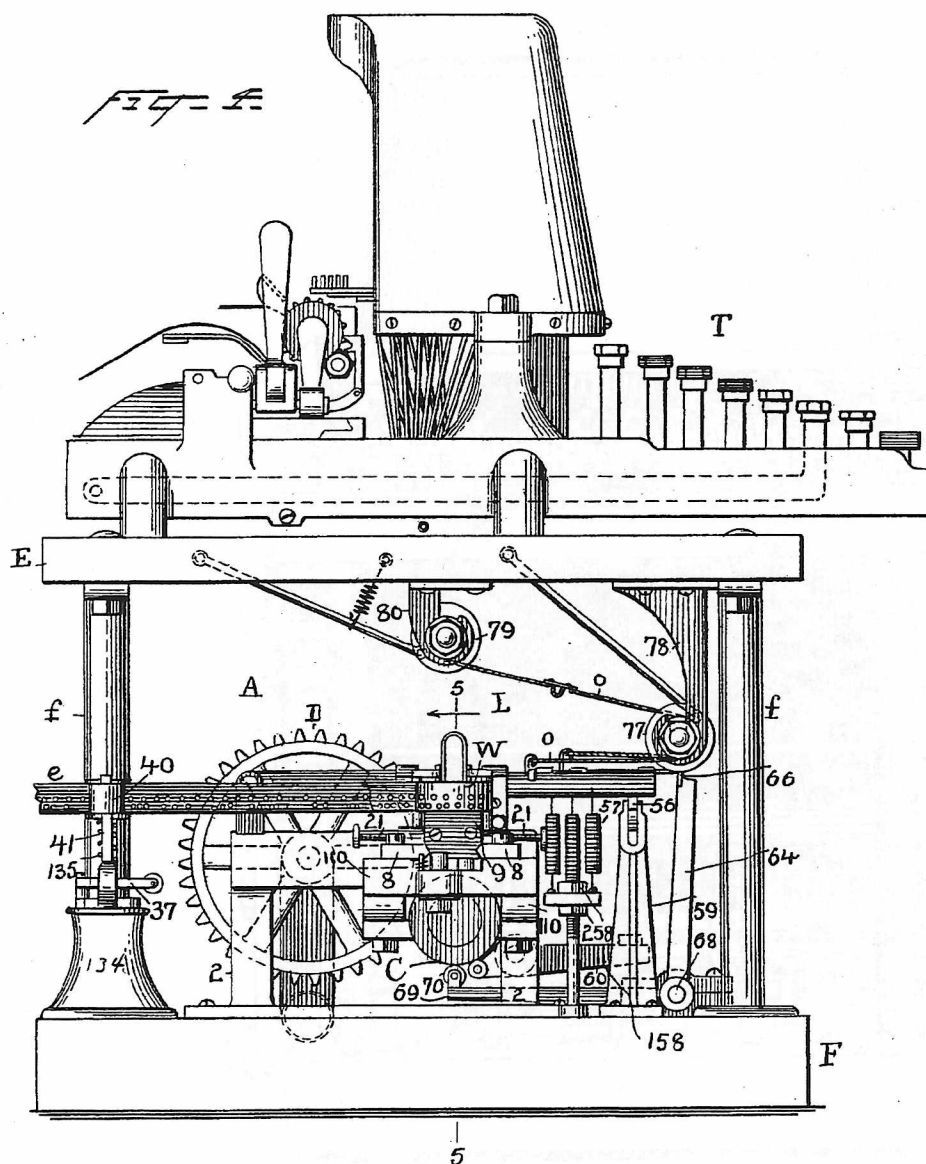
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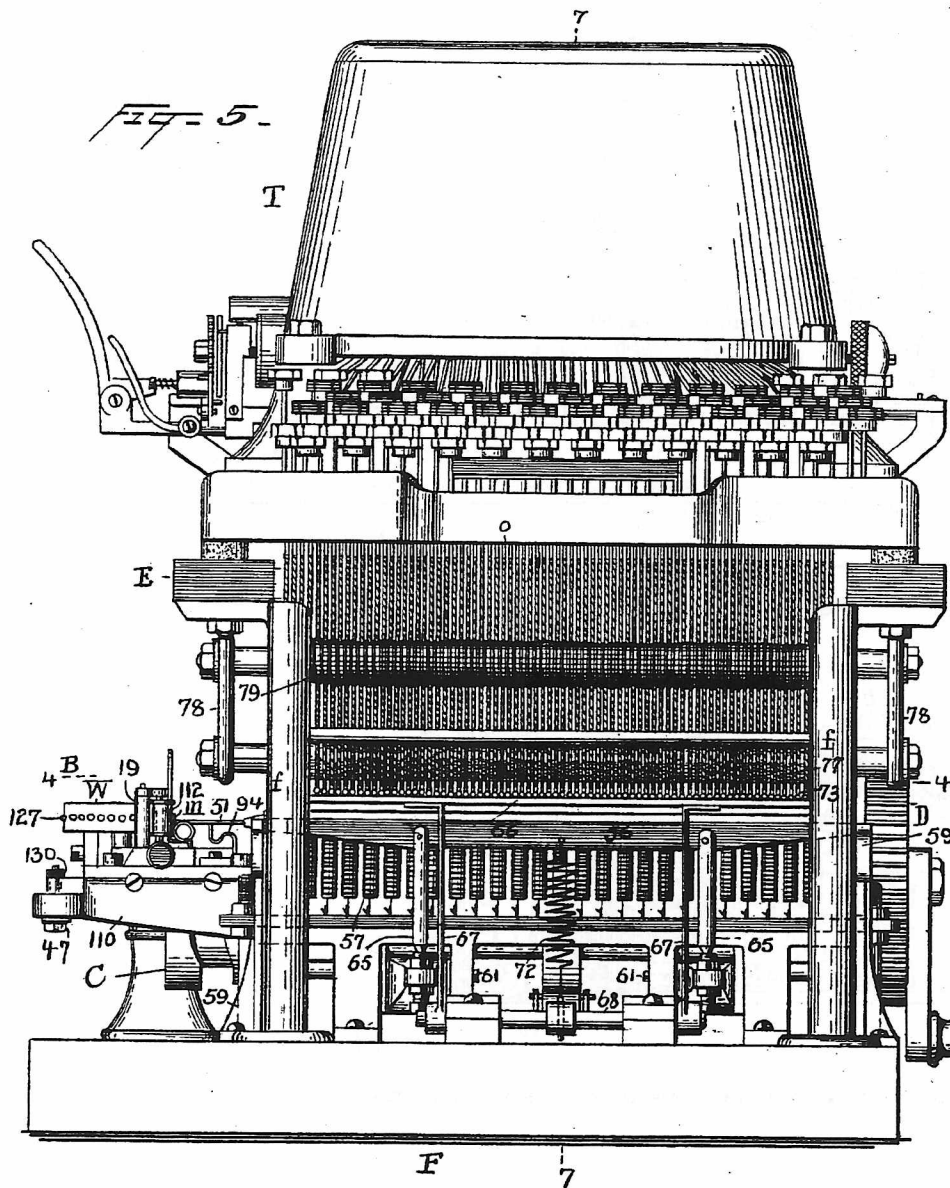
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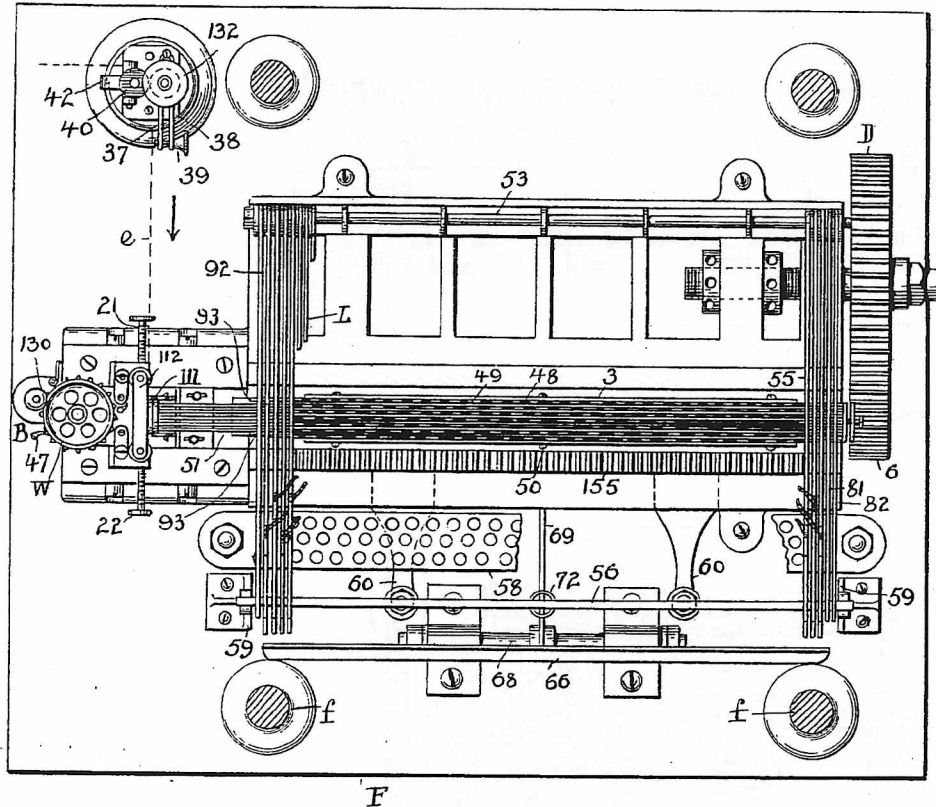
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(Application filed Nov. 28, 1899.)

9 Sheets—Sheet 5.

FIG. 5.



WITNESSES:

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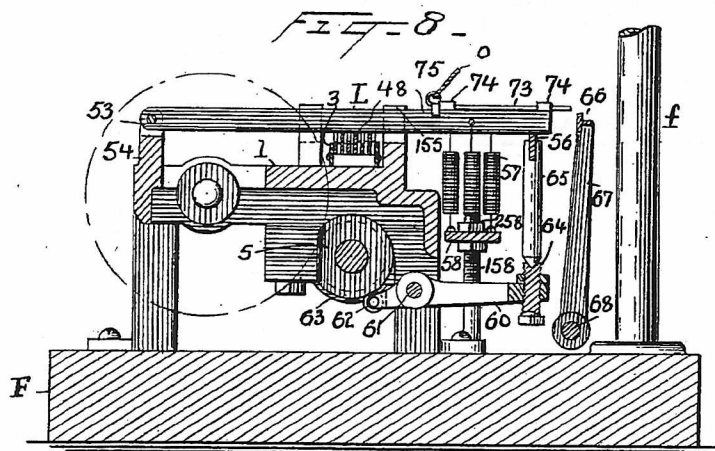
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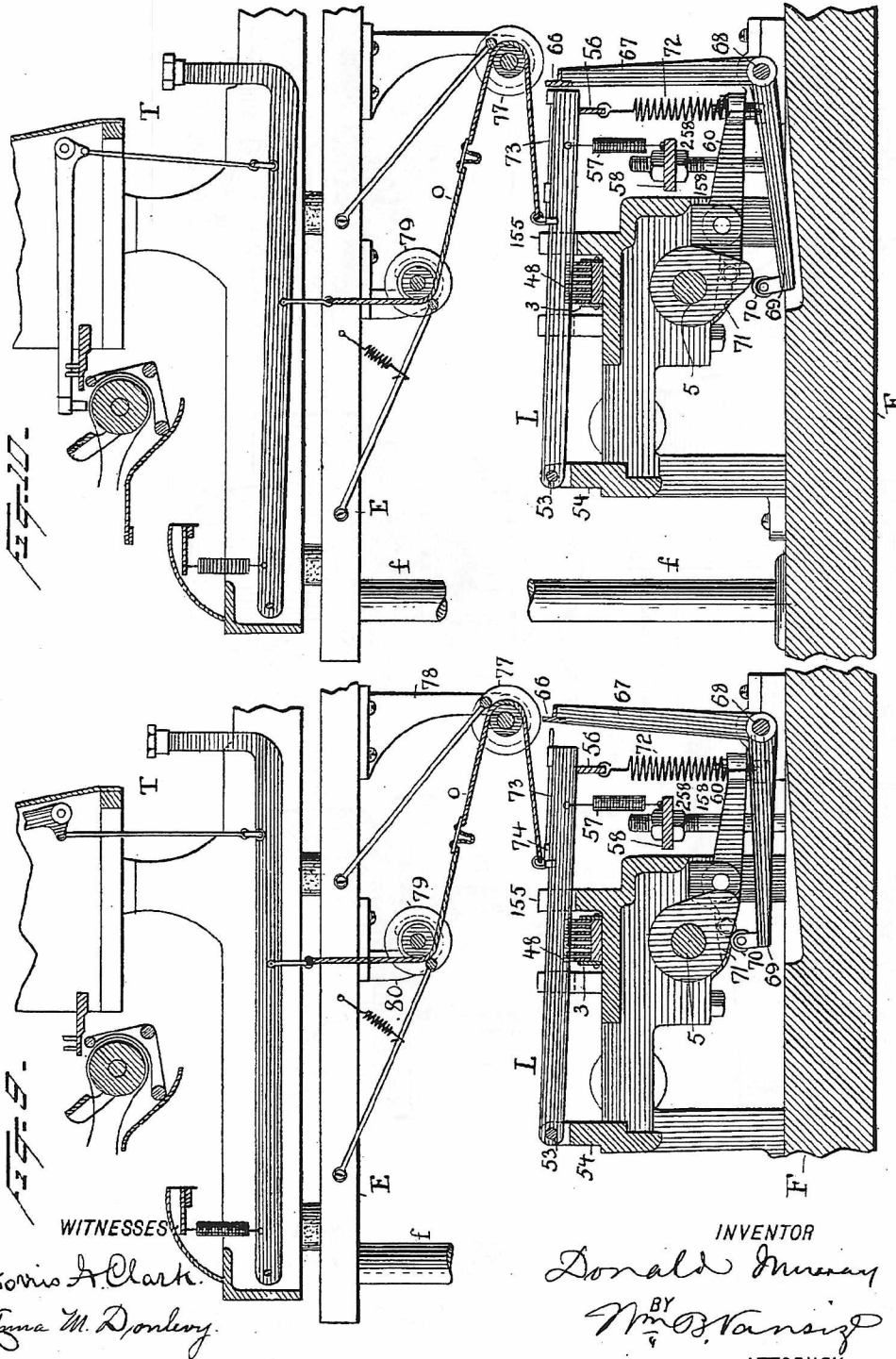
Patented July 17, 1900.

D. MURRAY.
PAGE PRINTING TELEGRAPH.

(Application filed Nov. 28, 1899.)

(No Model.)

9 Sheets—Sheet 7.



THE MORRIS PETERS CO. PHOTO-LITHO. WASHINGTON, D. C.

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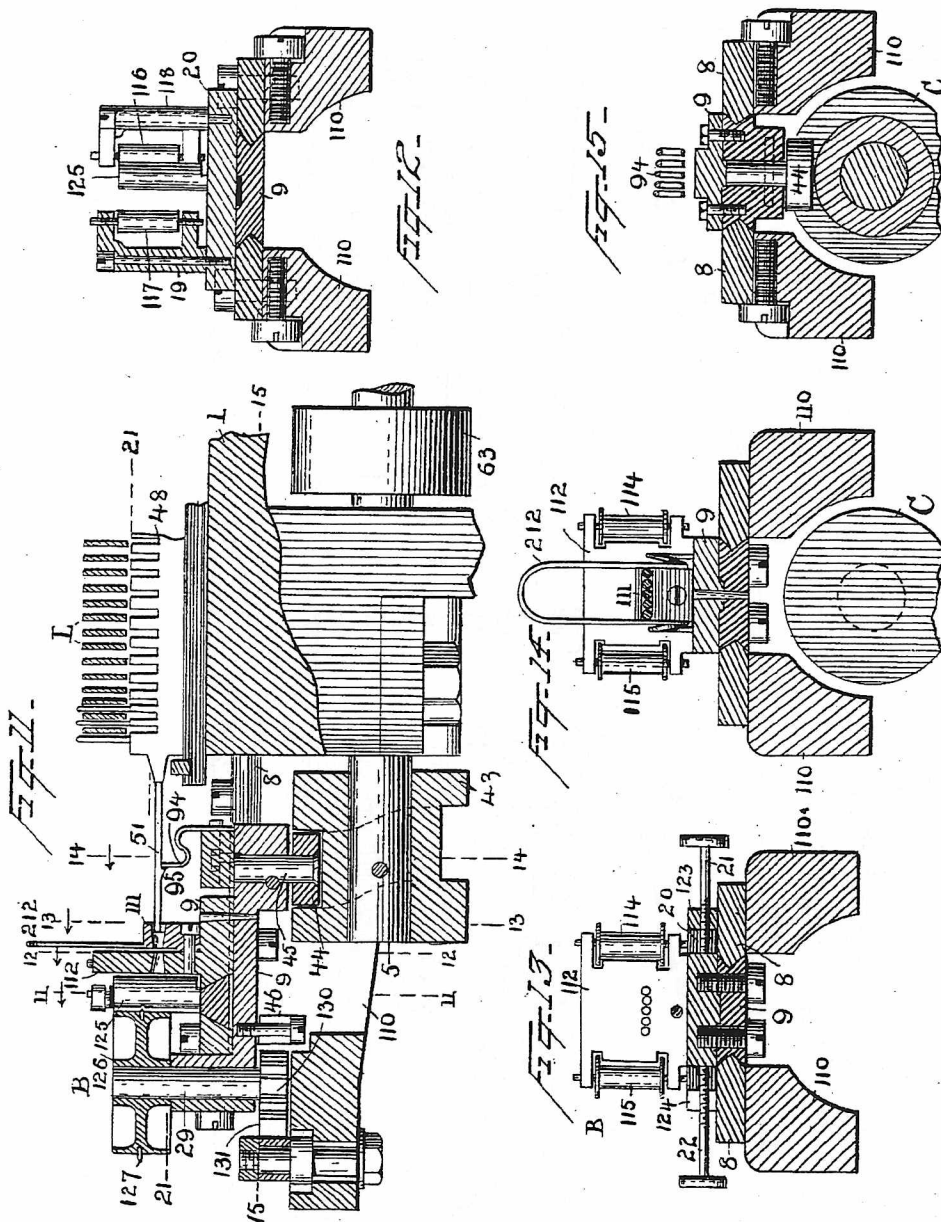
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9 Sheets—Sheet 8.



WITNESSES:

Horro A. Clark.
 Anna M. Donley.

INVENTOR

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BY
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No. 653,934.

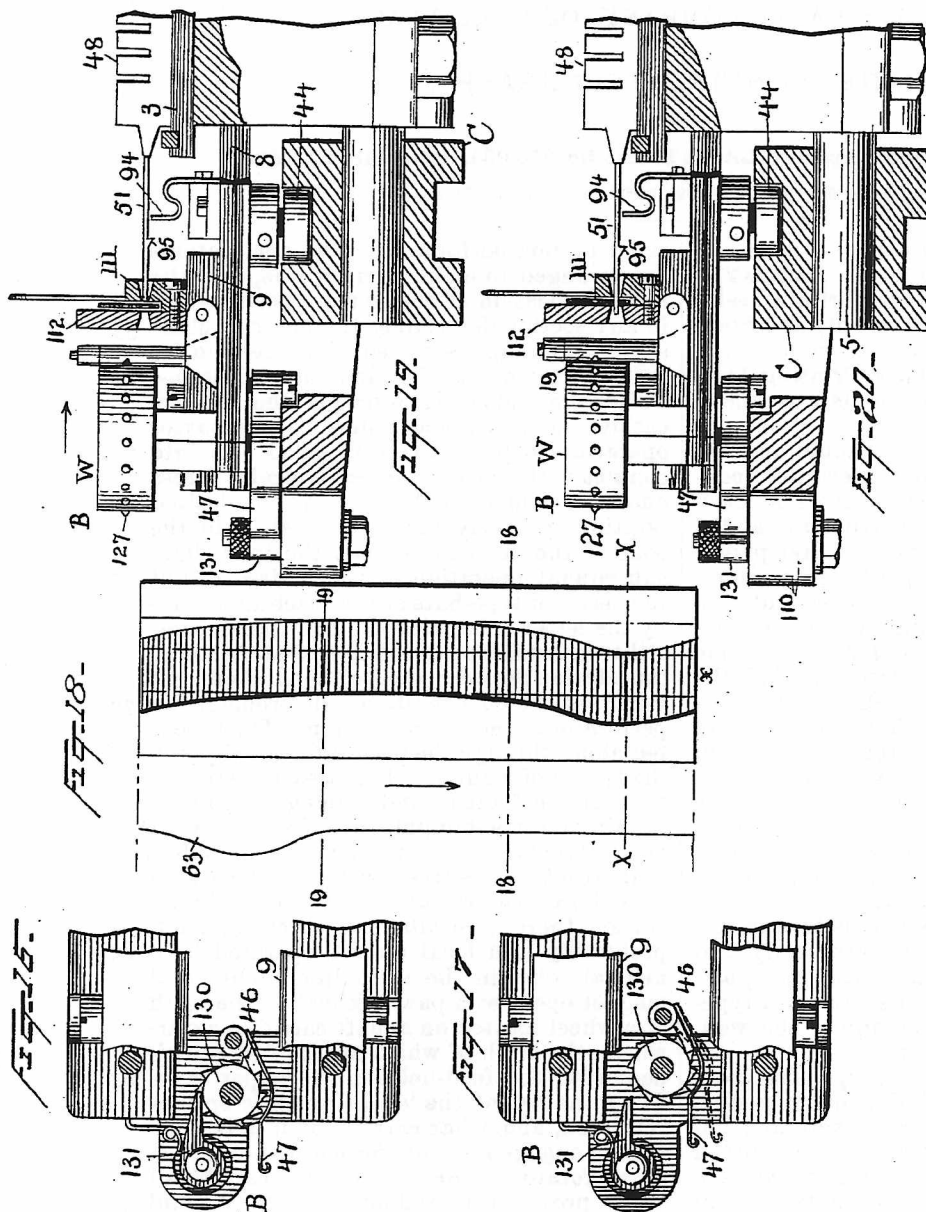
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WITNESSES:

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THE MURRAY-CLARK CO., PHOTO-LITHO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

DONALD MURRAY, OF NEW YORK, N. Y., ASSIGNOR TO THE POSTAL
TELEGRAPH-CABLE COMPANY, OF SAME PLACE.

PAGE-PRINTING TELEGRAPH.

SPECIFICATION forming part of Letters Patent No. 653,934, dated July 17, 1900.

Application filed November 28, 1899. Serial No. 738,552. (No model.)

To all whom it may concern:

Be it known that I, DONALD MURRAY, a subject of the Queen of Great Britain, residing in the city of New York, county and State
5 of New York, have made certain new and useful Improvements in Page-Printing Telegraphs, of which the following is a specification.

My invention consists in combining a recording instrument having a series of independently-movable character-levers, an electromagnetic perforating instrument, and a tape or strip of suitable material, like paper, which passes through the perforating and recording instruments in succession and providing means for advancing said tape the extent of a section or letter-space at a time through the recording instrument and the extent of a subdivision of such section or letter-space at a time through the perforating instrument. The perforator is connected with either a manual or an automatic transmitter at a distant station by a main-line telegraph-wire, and a suitable mechanical
25 actuating device is provided whereby the perforated tape is enabled to operate the type-writer or similar instrument.

The object of my invention is to transmit news and information telegraphically and deliver it in the form of a printed page, employing as the recording instrument a type-writing or type machine of any of the well-known forms in common use.

At the receiving-station the type-machine is provided with a series of independently-movable keys, each of which when actuated imprints a letter or character. To operate the type-writer, I employ an actuating device consisting of a series of notched bars or combs arranged compactly in parallel order having a capacity for reciprocating motion, the operating power being supplied by any suitable form of motor, such as an electric motor. These reciprocating combs are controlled by
45 a perforated tape, of paper or other suitable material. The tape is divided into a series of successive longitudinal sections—say one-half inch in length. Each section represents a letter or character and is divided into a predetermined number of elemental parts—say
50 five. Each such subdivision is either perforated or non-perforated.

The perforations are arranged in a single right line, and the relative location of one or more perforations in any section determines the letter or character. The tape is moved along section by section—say one-half an inch at each step—across the ends or terminals of the reciprocating combs of the actuator. The actuator operating to press the perforated slip into contact with the ends of said combs forces one, two, or more of them to take the desired position, properly alining the slots in the edge of the combs to permit the immediate subsequent operation of the desired one of the series of type-bars of the machine whereby the letter is imprinted. The transmitter, either manual or automatic, located at the distant station throws upon the line short current impulses, which operate an electromagnetic
70 perforator at the second station. The tape is fed along through the perforator step by step the length of a subdivision at each step, and the act of perforating and spacing is the result of a single current impulse of either positive or negative polarity. I employ current impulses that are either positive or negative, separated by a short space or break. At the receiving-station there is located an electromagnet, preferably in a local circuit, operated by a
80 neutral relay in the main line. The local magnet operates a pawl taking into the teeth of a wheel located on a shaft carrying a star-wheel, the teeth of which are located coincident with the feed-holes in the paper tape. The armature of the local magnet is spring-retracted, and a bar carried by it is in position to engage a simple form of paper punch or perforator. There is a finger capable of being projected in and out between the end
90 of the bar and the end of the punch. When this finger is withdrawn, the armature fails to engage with the punch and the paper is advanced one step while the perforator is not operated. This finger or intermediary is controlled by a polarized electromagnet in the main-line circuit. A series of makes and breaks of negative polarity operate the step-by-step mechanism, and the paper is fed along without perforating, while one or more
100 positive current impulses project the finger between the armature and punch and oper-

ate to perforate and space the paper. Each current impulse, whether perforating or spacing, moves the paper a single subdivision—say one-fifth—of a letter-section, which is, say, one-half inch.

The accompanying drawings illustrate my invention.

Figure 1 is an elevation of the type-writer with the actuator in position for operating or controlling it, the electromagnetic punching apparatus at the receiving-station, and a form of manual transmitter at the sending-station. Fig. 2 shows the arrangement of circuits and apparatus; and Fig. 3 is a section of the tape perforated to record a single word, combined with the positive and negative impulses and breaks employed in its production. Fig. 4 is an end elevation of the actuator applied to a type-writer. Fig. 5 is a front elevation of the same. Fig. 6 is a sectional plan view on the line 4 4, Fig. 5. Fig. 7 is a sectional front elevation of the same on the line 5 5 in Fig. 4. Fig. 8 is a transverse section of the same on the line 6 6, Fig. 7. Fig. 9 is a cross-section of the actuator applied to a type-writing machine, the section being taken on the line 7 7, Fig. 5, and showing a striking device employed as just beginning to operate. Fig. 10 is a similar section showing the striker as operated. Fig. 11 is an enlarged sectional front elevation of a portion of the actuating device to clearly illustrate the reciprocating carriage and the tape-feeding mechanism employed. Fig. 12 is a transverse section of the same on the line 11 11 in Fig. 11. Fig. 13 is a like section of the same on the line 12 12 in Fig. 11. Fig. 14 is a similar section of the same on the line 13 13 in Fig. 11. Fig. 15 is a like section of the same on line 14 14 in Fig. 11. Fig. 16 is a sectional plan view of part of the tape-feeding mechanism in position, the section being on the line 15 15 in Fig. 11. Fig. 17 is a similar view, but showing the parts in another position. Fig. 18 is a diagrammatic view of certain cams employed. Fig. 19 is a sectional front elevation showing the carriage and the feeding and controlling devices in one position. Fig. 20 is a similar view of the same, but showing the parts in another position.

Referring to Fig. 1, T is a type-writer or type-writing instrument having a suitable platen and a series of type presented at the recording-point by the operation of a series of key-levers *k*, respectively. The type-writer T is located upon a frame *f*, forming part of the actuator A. This actuator comprises a series of notched bars or combs arranged in parallel relation and capable of taking a reciprocating motion individually and collectively, the ends or terminals being pointed and presented at the rear of the feed-wheel W, around which the tape *e*, having a series of central feed-holes *h*, passes. The wheel W has a series of pins or projections in its periphery spaced to present themselves coincidently with the feed-holes *h*. Motive

power is supplied by any suitable motor, which may be either manually operated or driven by any known power. Such a motor is connected to the shaft carrying the driving-wheel D, which is geared to the cam-shaft C, through which the operation of the actuator is effected. There is a series of parallel levers L arranged side by side transversely above the combs, and each of the bars L is connected with a key-lever *k* through some flexible connecting device, like *o*, which passes around suitable pulleys, substantially as shown. The levers L are allowed to drop into effective operative position whenever the paper tape in its progressive movement section after section has allowed the arrangement of the combs in such a position that a series of notches, one in each comb, presents itself to one of the series of levers, and when this occurs that particular one of the series of levers L which is over a completely-aligned series of slots in the combs is allowed to drop and through the intermediate mechanism operates its key-lever *k* and a letter is imprinted. The actuator is mounted on a suitable base F, carrying standards 2 for supporting a table or bed-plate 1, on which are mounted to slide longitudinally assembling members, preferably in the form of combs 48, five in number, and controlled by a tape *e*, fed intermittently by a feed mechanism B, located on a reciprocating carriage 9 for moving the tape to and from the combs 48 and actuating the same according to the conduction of the tape, as hereinafter more fully described, said combs controlling the levers L, which in turn are connected with the corresponding parts of a type-writing machine.

The message on the tape is formed by groups of elements, of which each group represents a letter or character, so that when a group of elements assembles the corresponding combs the corresponding lever L will actuate the key representing the group of elements on the tape active at the time. Each group of elements, as shown, contains five elements, represented either by apertures or spaces. By having the elements in each group of a like number each letter or character occupies the same space on the tape, and the intermittent feed given to the tape by the feed mechanism B corresponds to the length of the space occupied by a single group, so that the combs corresponding to the group active at the time are actuated for actuating the corresponding lever L. Owing to the uniformity of the feed of the tape and the equal spaces occupied by the group of elements it is possible for the groups of elements to be placed one after the other without intervening spaces and without danger of error.

The combs 48 are provided at the ends adjacent to the carriage 9 with pins or fingers 51, adapted to be engaged by a group of elementary apertures and spaces on the tape as the latter is moved bodily with the carriage to the right. When this takes place, the

combs, with pins registering with apertures or perforations, are engaged by the latter and remain dormant, while the pins in register with the spaces are engaged by the solid parts of the tape and are shifted by the latter to assemble such combs and bring their slots in register with each other for the corresponding lever L to drop in such registering slots.

On the bed-plate 1 is a slideway 3, and from the said bed-plate depend hangers 4, in which is journaled a shaft 5, which may be rotated by any suitable means. I have here shown it as provided with a pinion 6 for engaging with a driving-gear D, which is provided with a crank, so that it may be operated manually; but said shaft 5 may be driven from other suitable machinery by gearing or belt-and-pulley connections. Extended from one end of the bed-plate 1 is a guideway 8 for the reciprocating carriage 9 to slide on, said guideway consisting of plates secured to brackets 110, projected from the bed-plate 1. The inner edges of these plates engage in grooves on each side of the carriage, so that while the carriage may reciprocate back and forth it is restrained from any other movement.

Mounted on the carriage 9 are perforated plates 111 and 112, between which the tape *e* is designed to pass, the perforations in the plates 111 and 112 being designed to act as guides for the passage through the tape-perforations of the fingers 51, extending from the controlling-combs 48, as previously mentioned. The plate 112 also acts as a support for the tape, while its solid portions are thrust against the corresponding fingers 51 of the said combs 48. On the ends of the plates 112 are vertically-disposed rollers 114 and 115, and rearward of said plate 112 are guide-rollers 116 and 117, Figs. 11, 12, 13, 14, and 15. These guide-rollers 116 and 117 are mounted, respectively, in brackets 118 and 119, held on a bar 20, adapted for adjustment transversely of the carriage, and for this purpose I employ set-screws 21 and 22, engaging tapped apertures formed in arms 123 and 124, extending from said bar 20, and the inner ends of these set-screws (see Fig. 13) impinge against the sides of the carriage. Obviously by manipulating these screws the rollers 116 and 117, and therefore the tape, may be adjusted. The object of providing for this adjustment of the guide-rollers 116 and 117 transversely of the carriage is to permit of minute adjustment of the tape and which adjustment may be necessary to cause the elementary perforations to properly align with the fingers of the combs 48; but this adjustment once made rarely or never needs changing. A spring-guide 212 is held on the carriage, straddles the plate 111, and serves to hold the tape against the face of the plate to prevent accidental shifting of the tape during the time the tape is active for shifting the combs.

Adjacent to the roller 116 and mounted on the sliding bar 20 is a curved shield-plate 125,

designed to prevent buckling of the tape as it passes along under the influence of the feeding mechanism. In other words, while the tape is being fed by the feeder or star-wheel W it will strike against the concave side of the shield-plate 125 and will be directed to a basket or other suitable receptacle without danger of its folding or returning upon the star-wheel. This star-wheel or feeder W has on its periphery a series of pins 127, (see Figs. 11, 19, and 20,) adapted to engage in perforations *h*, formed in the tape *e*. The star-wheel W is mounted on a vertical shaft 29, adapted to rotate in the carriage 9, and on the lower end of said shaft 29 is a ratchet-wheel 130, designed to be engaged by a spring-pressed pawl 131, (see Figs. 16 and 17,) mounted on the bracket 110.

Reciprocating motion is imparted to the carriage 9 (see Figs. 7, 11, 19, and 20) by means of a cam-pulley C, mounted on the driving-shaft 5, said cam-pulley having a peripheral groove engaged by a roller 44, loosely mounted on a stud 45, depending from said carriage. As the cam-pulley C moves the carriage 9 toward the bed-plate of the machine the ratchet-wheel 130 will of course be disengaged from the pawl 131; but upon the reverse movement of the carriage a tooth of the said ratchet-wheel will engage with said pawl 131, so that the star-wheel W will be rotated a sufficient distance to move the tape through one section. The star-wheel is held from backward rotation while the carriage is moving forward by means of a spring-pressed dog 46, mounted on the carriage and engaging with the ratchet-wheel. (See Figs. 16 and 17.)

The combs 48 are movable longitudinally on the slideway 3 and are held separately in a vertical position by means of pins 52, extended upward from the bottom of the slideway 3 and between adjacent combs, as is plainly indicated in Fig. 7. Some or all of the combs 48 are shifted at a time to the right by the action of the tape moved bodily with the feed mechanism, and in order to insure a return movement of the combs to the left during part of the return stroke of the carriage I provide the under side of each finger 51 with a lug 95, adapted to be engaged by a spring arm or finger 94, mounted on a block adjustably secured to the carriage 9, so that when the latter is on the return or outward movement the arms or fingers 94 engage the lugs 95 of the previously-shifted combs to return the latter to their normal position. (Shown in Fig. 11.)

The several combs 48 are provided in their top edges with slots variously placed, and the slots are designed to govern the levers L, mounted to swing independently of each other on a rod 53, secured in standards 54 on the bed-plate 1, said levers L being mounted to swing in fixed guideways 155 to restrain the parts from sidewise motion. The number of levers L will correspond to the number of letters contained in the machine to which my device is applied, and said levers L are de-

signed to have connection by means of cords or other devices with the several keys *k* of such type-machine. The levers *L* extend transversely of the combs 48 and are supported at their ends normally above the several combs by means of a supporting-bar 56, and they are held yieldingly against said supporting-bar and are adapted to swing downward at the proper time by means of springs 57, connected at one end to the levers *L* and at the other end to a cross-bar 58, supported on a threaded standard 158, so that the tension of the springs 57 may be adjusted by nuts 258. (See Figs. 8, 9, and 10.) The ends of the supporting-bar 56 are movable in slots formed in standards 59, and said bar is moved upward by means of posts 65, mounted on the outer ends of two levers 60, rocking on shafts 61, and said levers 60 are provided at their inner ends with rollers 62, engaging with cams 63, attached to the shaft 5. (See Fig. 7.) As a means of adjusting the bar 56 vertically I provide step-bearings 64, adjustable through the levers 60, and these bearings are preferably made in the form of screw-bolts, which in their upper ends have depressions for receiving the lower pointed ends of the posts 65, depending from the bar 56. Forward of the supporting-bar 56 and also forward of the levers *L* is a striking-bar 66, mounted on the upper ends of arms 67, projecting upward from a rock-shaft 68. On the latter is arranged an inwardly-extending arm 69, carrying at its free end a roller 70, engaging the peripheral surface of a cam 71, mounted on the shaft 5 between the cams 62 and 63. A spring 72, connected at one end to the supporting-bar 56 and at the other end to the arm 69, serves two purposes—one to depress the bar 56 and the other to hold the roller 70 in contact with the cam 71.

Mounted to slide on each key-lever *L* is a tappet-rod 73, (see Figs. 9 and 10,) movable through guideways 74 on the lever *L*, and the outer end of said tappet-rod extends normally forward of the end of the lever to which it is attached. A stop 75 on the inner end of the tappet-rod engages against each side of the lever *L*, and said stops not only prevent the tappet-rods from rotating in their bearings, but also, by coming in contact with the inner bearing 74, prevent the tappet-rods from moving too far in an outward direction. From the inner end of the tappet-rods 73 extend cords or other suitable connections *c* around idler-pulleys 77, mounted on a rod supported in hangers 78, said cords then extending around idler-pulleys 79, supported in hangers 80, and from these idler-pulleys 79 the cords extend to connect with the keys of the type-machine to be operated.

The tape *e* is fed from a roll supported in any suitable manner, and preferably it will pass through a tension device (see Fig. 6) before it reaches the star-wheel *W*, so as to keep said tape under proper stress. The tension device is provided with a roller 132, supported

on a stem 133, extending from a base 134, attached to the main base *F*, and said roller 132 is prevented from revolving freely on the stem 133 by a spring 135, which surrounds the stem and engages at one end with the roller 132 and at the other end with a sleeve 36, mounted loosely on the stem 133. The tension of the spring 135 may be adjusted by means of clamping-jaws 37 and 38, which engage the periphery of the sleeve 36, and said jaws 37 38 are connected at one end to the base 134, and at the opposite ends they are connected to each other by an adjustable bolt 39. By the operator manipulating the nut on the bolt 39 the jaws 37 and 38 may be caused to bear with greater or less friction upon the sleeve 36, and the tension of the spring 135 will be regulated accordingly. The tape is held against the roller 132 by means of a presser-roller 40, mounted on a rod 41, having swinging connection with the base 134, and said roller 40 is yieldingly held toward the roller 132 by means of a spring 42, attached to one end of the base or to any other fixed device and bearing at its free end against the rod 41, as plainly indicated in Fig. 8.

The form of tape employed by me is, as shown in Fig. 3, composed of paper having a series of central feed-holes *h*, and when passing through the actuator this tape is stepped forward one letter-section, indicated by the distance between the transverse dotted lines, which is equivalent to one complete letter-space. The perforations which render a letter-space characteristic and which determines the letter to be recorded are arranged in a right line longitudinally at one side of the feed-perforations. I divide the section or space assigned to a letter upon the tape into five elemental parts or subdivisions, and my alphabet is based upon the relative location of these perforations within the limits of a letter-space or single step of the actuator-feeding device. In Fig. 3 I have represented the word "Paris." The letter "P" within the letter-space assigned to it is composed of a series of perforations occurring in the second, third, and fifth subdivisions of the letter space or section. The letter "A" is composed of perforations occurring in the first and second subdivisions of a letter space or section; the letter "R," perforations in the second and fourth subdivisions; the letter "I," perforations in the second and third subdivisions, while with the letter "S" the first and third subdivisions are perforated. It will thus be seen that the tape is divided into a series of equal successive sections, each section being divided into an equal number of subdivisions, each of equal length. In transmitting intelligence telegraphically the tape is stepped along one of these subdivisions of a letter space or section at each step. The succession of currents employed is shown, together with its polarity, in Fig. 3, at 30. Impulses graphically represented above the line and opposite perforations in the tape are assumed to be positive,

those below the line negative, and the current breaks are indicated by a space between impulses. Both positive and negative impulses actuate the spacing mechanism and serve to step the paper ahead, but only the positive impulses operate to perforate. In the preparation of this tape as the record of transmitted intelligence or as a medium in the transmission of intelligence I may employ at the transmitting-station a manually-operated transmitter *t*, having a series of independently-movable letter-bars. This transmitter has three rotating cylinders 10 11 12, geared together and rotating in the same direction at the same speed. The cylinder 11 is electrically connected with a grounded generator 13. The cylinder 12 is similarly connected with a grounded generator 14. The generators and cylinders are of opposite polarity, respectively. Upon the periphery of each cylinder there are teeth or projections, like 15. These are arranged in alternation, spaces on one cylinder being presented at the contact position simultaneously with contact-points on the other. The brushes, like 16, carried by the key-bars of *t*, are employed to make electrical contact. The rotating cylinder 10 is provided with a circumferential groove opening at 18. A hook 17, carried by the key-bar, enters this groove when the bar is depressed, and the key-bar is held down during a complete revolution of the cylinders, the arrangement being such that a second key cannot be depressed while the first key is transmitting its signal. At the receiving-station I provide a reciprocating paper-punch 23, having a retracting-spring 24. There is a stop-screw 21 and a hollow anvil 27, against which the paper and punch are projected, and there is a guide 26, through which the punch 23 passes. The paper tape *e* is carried around a wheel *w* and is guided and controlled by the rollers *r*. The wheel *w* has teeth or projections which are coincident with the central line of feed-perforations in the tape. On the shaft 31, carrying the wheel *w*, there is a toothed wheel 32. *m* is an electromagnet having an armature 34. A finger 33, carried by the armature 34, engages the teeth of the wheel 32 and through the action of the retracting-spring *s* the wheel *w* is stepped ahead, feeding the tape *e* the distance of one subdivision or elemental part of a letter, as already described, and this is done upon each and every up-and-down movement of the armature 34. The opposite end of the armature-bar is in position to engage with the punch 23 and force it through the paper, provided the finger 25 is in position to act as a medium for completing the connection. If, however, the finger 25 is withdrawn, the armature-lever moves without affecting the punch. The magnet *m* is in a local circuit *c*, containing a battery *b*, operated by break-points controlled by the neutral main-line relay *n*. The finger 25 is controlled by the polarized main-line relay *p*. Upon the occurrence of a positive impulse the finger 25

is carried into position, as shown in the drawings, while a negative impulse withdraws the finger 25, carrying the relay-tongue to its opposite limiting-stop.

The operation of the apparatus is as follows: Let us assume that the last letter shown on the tape in Fig. 3 is to be transmitted—that is, the letter “S.” This consists of a perforation in the first and third subdivisions of the letter-space. If the key of *t* shown were depressed and the projections shown on the cylinders 11 and 12 presented themselves to the contacts, the result would be the perforation of this letter. The current impulses would be as shown in the line 30, Fig. 3, the impulses occurring in the following order: positive, break, negative, break, positive, break, negative, break, negative, break, or a total of five current impulses and five breaks, the electromagnet *m* and the retracting-spring *s*, connected therewith, operating to feed the paper five steps or subdivisions of the letter or letter-section of the tape. At each positive current impulse the relay *p* projected the finger 25 into the position shown, enabling the armature 34, pivoted at 35, to make connection with the punch and force it through the paper, while at every negative impulse the finger 25 is withdrawn, thus preventing the armature-lever 34 from making connection with the punch. The neutral relay *n*, responding to every current impulse of either polarity and its succeeding break, would make and break the local circuit *c* five times, producing five successive movements up and down of the armature 34, carrying the finger 33. The succession of current impulses for every other transmitted character are positive and negative, with intervening breaks; but in case of each letter the succession of positive and negative impulses has a characteristic difference.

The type-writing mechanism and the controlling mechanism for the same herein shown and described are shown, described, and claimed in United States Letters Patent No. 638,591, dated December 5, 1899, issued to me for improvements in actuating mechanism for key-operated machines.

What I claim, and desire to secure by Letters Patent, is—

1. The combination of a single main telegraph-line connecting separated stations, a suitable circuit-changing transmitter in said line at one station, a movable medium as a paper tape or strip, at a second station, means for advancing said medium step by step, a device to perforate said medium with a series of successive holes arranged in a single right line, a main-line relay controlling the step-by-step mechanism through the medium of a local circuit and a polarized magnet in the main line controlling the perforating device.
2. The combination of a single main telegraph-line connecting separated stations, a suitable circuit-changing transmitter at one station, a movable medium, as a paper tape,

at a second station, an electromagnet for starting and stopping the advance movement of said medium; a punch to perforate said medium with a series of successive holes arranged in a single right line and a polarized magnet for controlling the action of said punch.

3. The combination of a single main telegraph-line connecting separated stations, a pole-changing transmitter in said line at one station, a movable controlling medium at a second station, a punch arranged to perforate said medium with a series of successive holes in a single right line, means for advancing said medium step by step, controlled by an electromagnet, a relay in the main line, a local circuit therefor containing the first-named electromagnet, and a polarized relay in the main line controlling the operation of the punch, substantially as described.

4. The combination of a single main telegraph-line connecting separated stations, a pole-changing transmitter in said line at one station, a movable medium, as a paper tape, at the second station, a punch for perforating holes in said tape in a single right line, means for starting and stopping the advance of said movable medium and for controlling the action of the punch, a type-writing machine having a series of independently-movable keys, an actuating device therefor including a series of parallel, reciprocating, notched bars controlled by the perforated tape, and a motor for said actuating device.

5. In a page-printing telegraph the combination of a type-writing machine having a series of independently-movable keys, an actuating device therefor including a series of parallel, notched bars, and a controlling-tape having a series of holes arranged in irregular succession in a single right line, a suitable motor for operating said actuating device, an electromagnetic punch at the receiving-station for perforating said tape, a circuit-changing transmitter at the distant station and a single main telegraph-line connecting the transmitting and receiving stations.

6. The combination of a type-writing or other type machine having a series of independently-movable keys, an actuating device therefor including a series of parallel, reciprocating, notched bars, a controlling medium for said actuating device consisting of a paper tape or strip having a series of holes or perforations arranged in a single right line in predetermined succession and extent, a motor to drive said actuating device and an

electromagnetic perforating device for said controlling medium.

7. A tape or strip for controlling a type-writing or other type machine, said tape being divided into a series of equal, successive, longitudinal sections, each section representing a letter or character, which is divided into perforated or non-perforated subsections of equal number and length, the perforations being arranged in a single, right line; the relative location of one or more perforations in any section determining the letter or character; combined with means for advancing said tape step by step the extent of a section at each step.

8. The combination of a recording instrument having a series of independently-movable character-levers, an electromagnetic perforating instrument and a tape or strip of suitable material passing through the perforating and recording instruments in succession, means for advancing said tape the extent of a section at a time through the recording instrument and the extent of a subdivision of a section at a time through the perforating instrument.

9. A tape or strip and a recording apparatus operating to advance said tape section by section combined with a device for advancing said tape in a series of uniform subdivisions of such section, a punch for perforating said tape and an electromagnet in the main line to control said punch.

10. In a perforator the combination of a reciprocating punch, an electromagnetic actuator therefor located in the main telegraph-line, means for mechanically connecting and disconnecting the punch and actuator and an electromagnet controlling said means having its coils in said main line.

11. The combination of a single main telegraph-line connecting separated stations, a pole-changing transmitter in said line at one station, a movable medium as a paper tape at a second station, a punch for perforating holes in said tape in a single right line, an electromagnetic device for operating said punch and advancing the paper step by step, a local circuit for said electromagnet with a neutral magnet and a polarized magnet in the main line cooperating to control said electromagnetic device and perforator.

DONALD MURRAY.

Witnesses:

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ANNA M. DONLEVY.

No. 685,427.

Patented Oct. 29, 1901.

D. MURRAY.

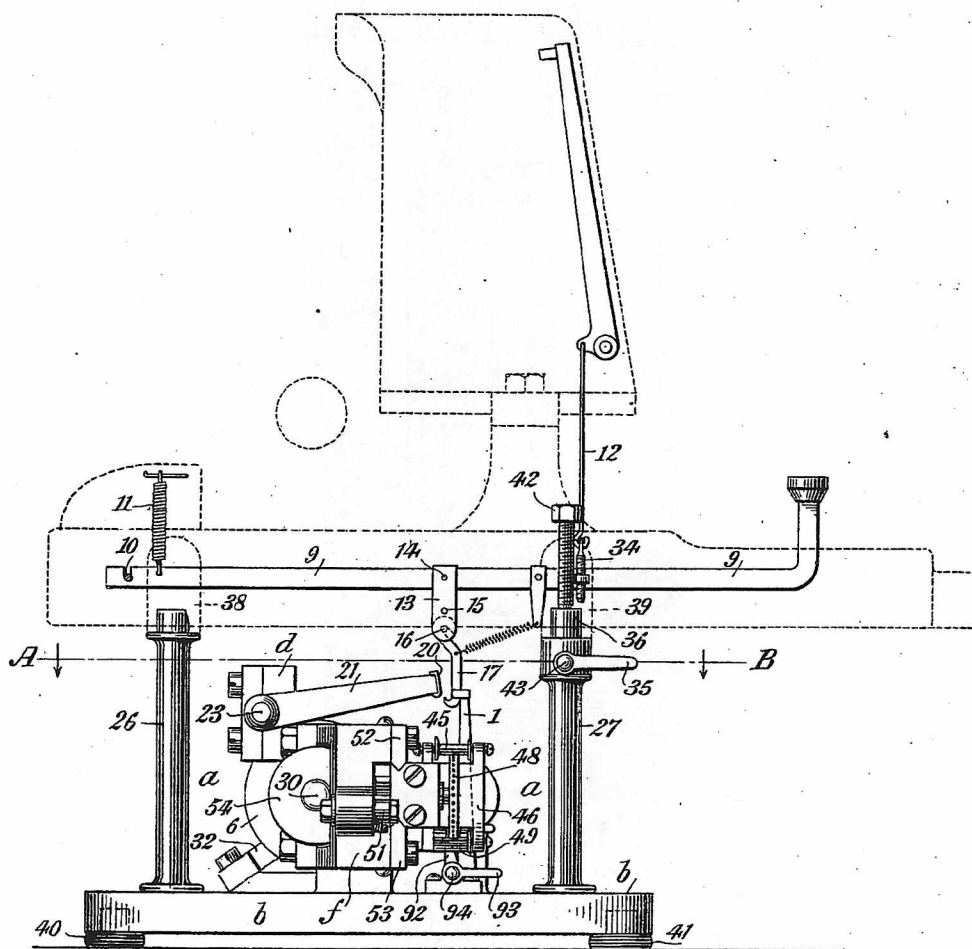
AUTOMATIC ACTUATING MECHANISM FOR KEY OPERATED MACHINES.

(Application filed Jan. 30, 1901.)

(No Model.)

7 Sheets—Sheet 1.

Fig. 1.



WITNESSES:

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INVENTOR:

Donald Murray
By his Attorney
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THE MORRIS PETERS, CO., PHOTO-LITHO., WASHINGTON, D. C.

No. 685,427.

Patented Oct. 29, 1901.

D. MURRAY.

AUTOMATIC ACTUATING MECHANISM FOR KEY OPERATED MACHINES.

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(No Model.)

7 Sheets—Sheet 2.

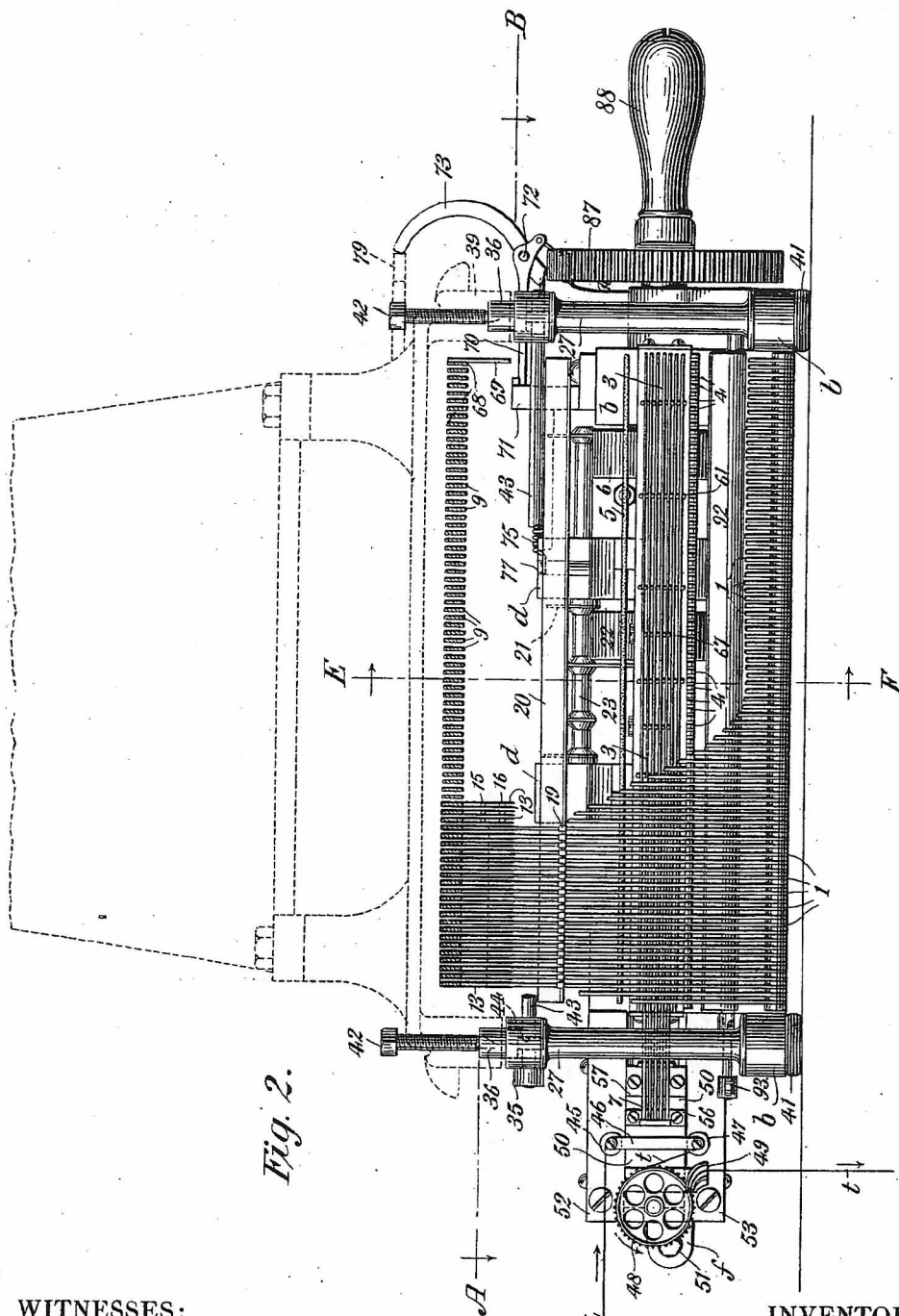


Fig. 2.

WITNESSES:

C. E. Ashley
A. M. Donlevy

INVENTOR:

Donald Murray
By his Attorney
W. B. Vansly

No. 685,427.

Patented Oct. 29, 1901.

D. MURRAY.

AUTOMATIC ACTUATING MECHANISM FOR KEY OPERATED MACHINES.

(Application filed Jan. 30, 1901.)

(No Model.)

7 Sheets—Sheet 3.

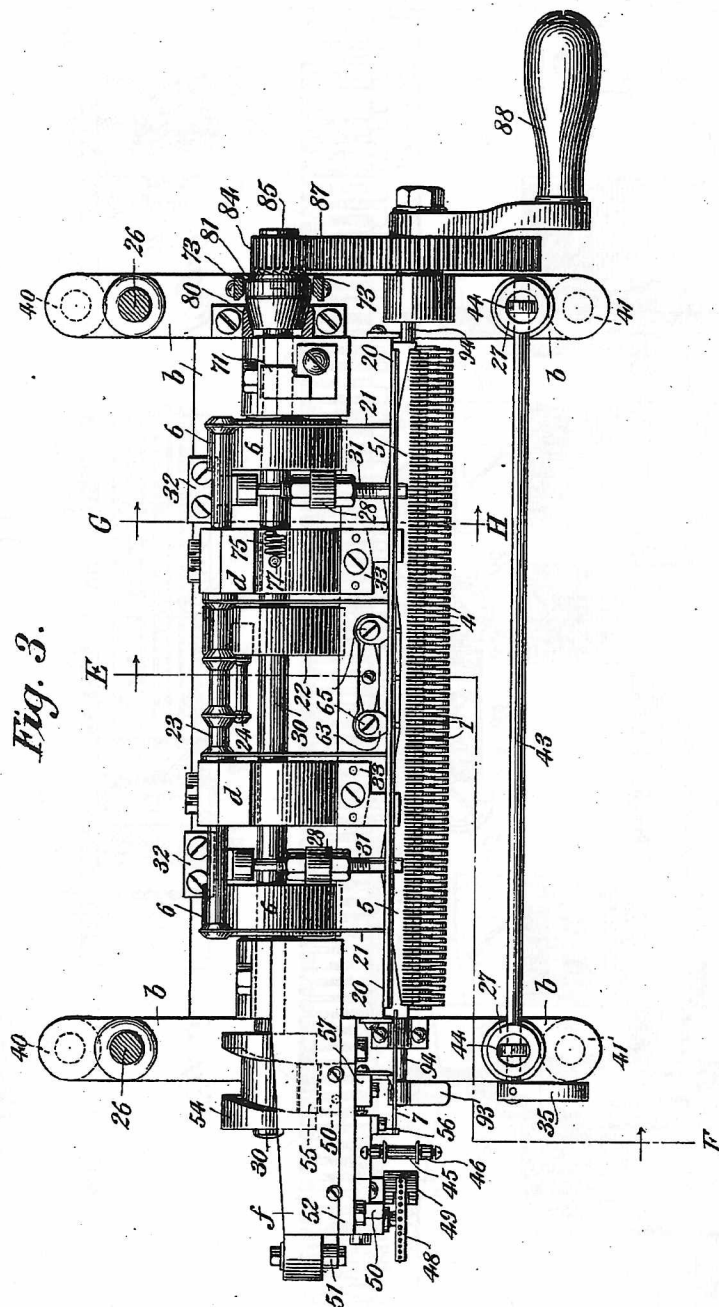


Fig. 3.

WITNESSES:

C. E. Ashley
A. M. Donley

INVENTOR:

Donald Murray
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M. D. Vane

THE MORRIS PETERS CO. PHOTO-LITHO., WASHINGTON, D. C.

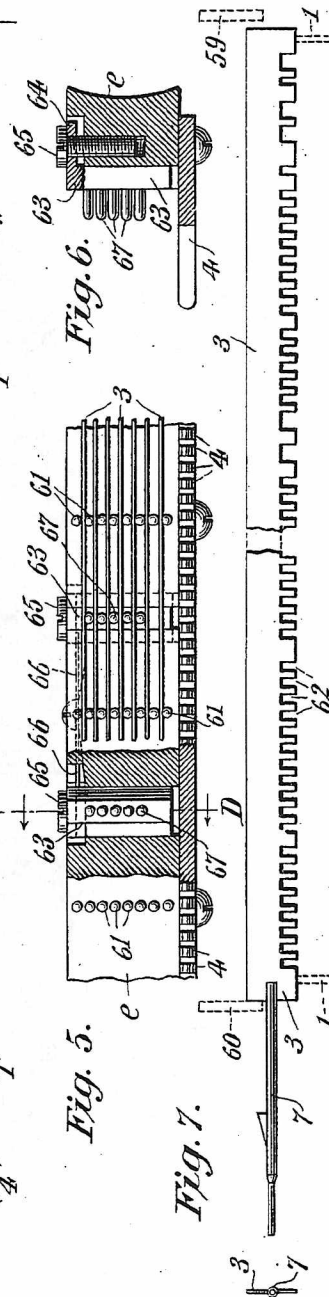
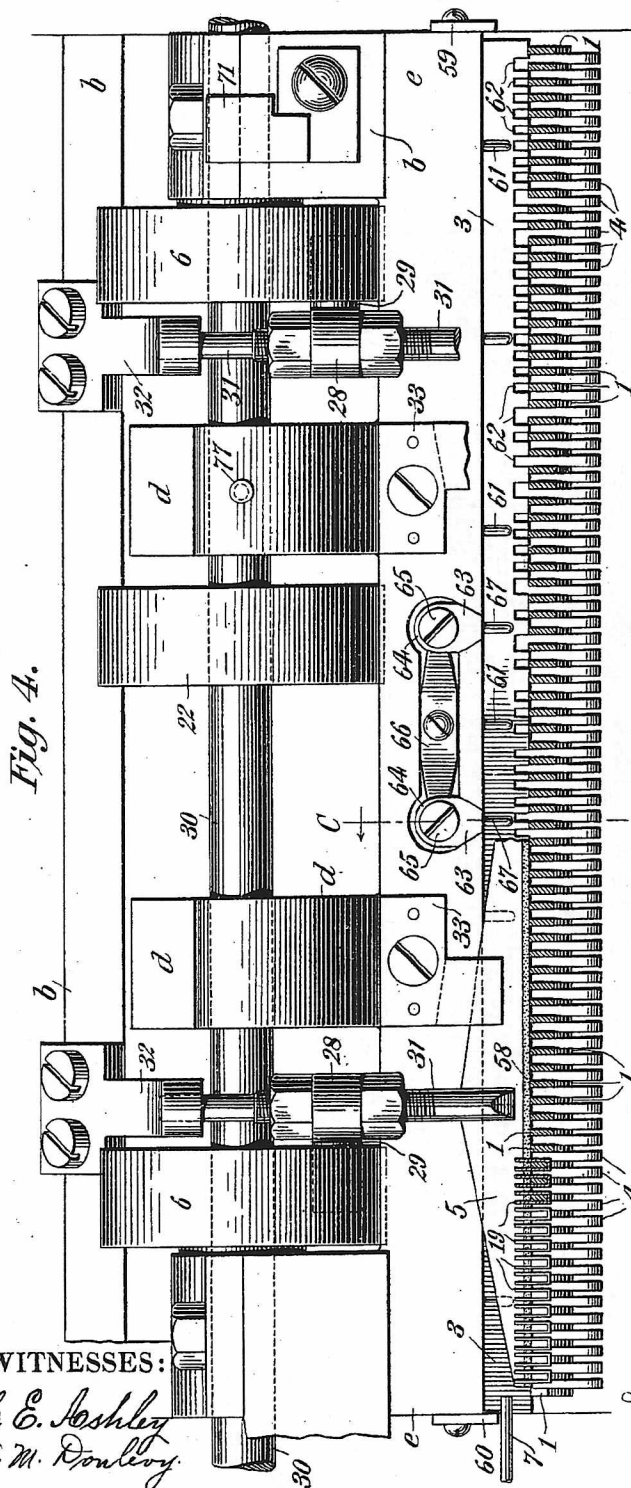
D. MURRAY.

AUTOMATIC ACTUATING MECHANISM FOR KEY OPERATED MACHINES.

(Application filed Jan. 30, 1901.)

(No Model.)

7 Sheets—Sheet 4



WITNESSES:

C. E. Ashley
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No. 685,427.

Patented Oct. 29, 1901.

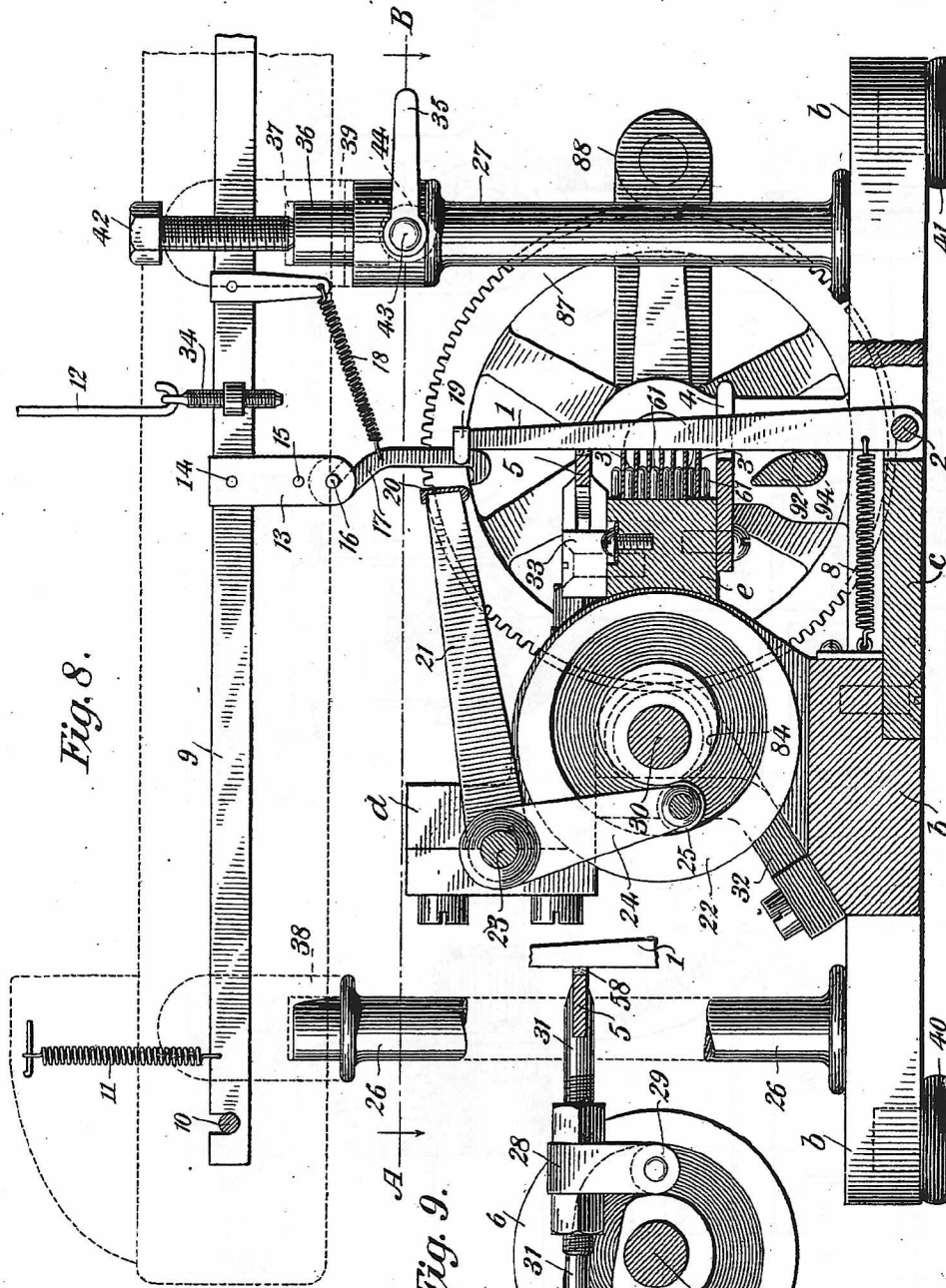
D. MURRAY.

AUTOMATIC ACTUATING MECHANISM FOR KEY OPERATED MACHINES.

(Application filed Jan. 30, 1901.)

(No Model.)

7 Sheets—Sheet 5.



WITNESSES:

C. E. Ashley
A. M. Donlevy

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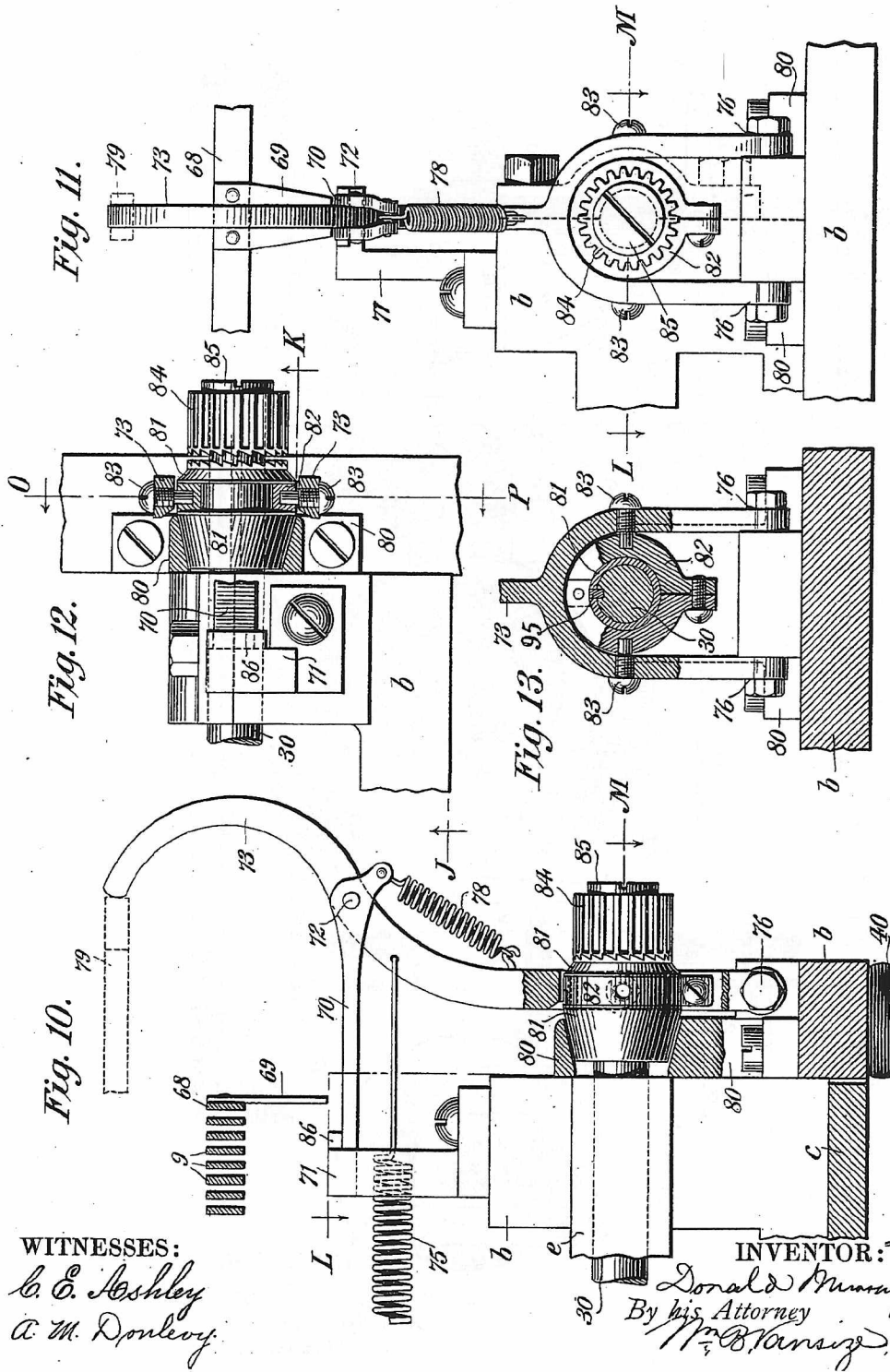
D. MURRAY.

AUTOMATIC ACTUATING MECHANISM FOR KEY OPERATED MACHINES.

(Application filed Jan. 30, 1901.)

(No Model.)

7 Sheets—Sheet 6.



WITNESSES:

C. E. Ashley
A. M. Donlevy

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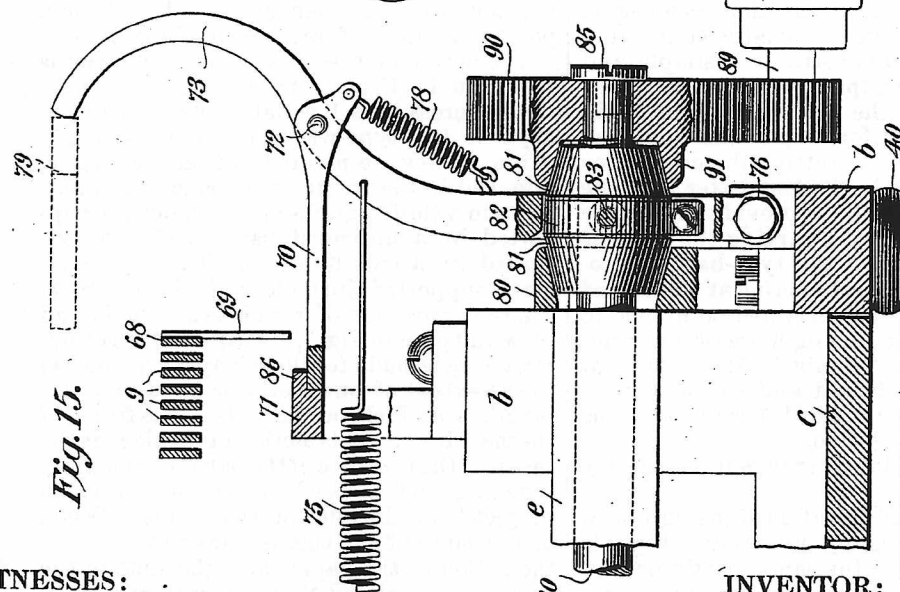
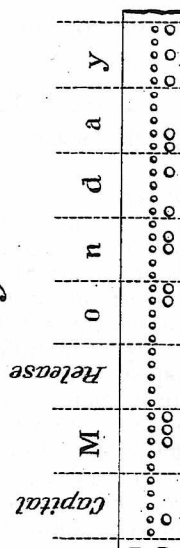
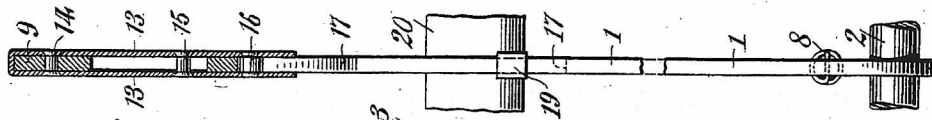
D. MURRAY.

AUTOMATIC ACTUATING MECHANISM FOR KEY OPERATED MACHINES.

(Application filed Jan. 30, 1901.)

(No Model.)

7 Sheets—Sheet 7.



WITNESSES:

C. E. Ashley
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INVENTOR:

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UNITED STATES PATENT OFFICE.

DONALD MURRAY, OF NEW YORK, N. Y.

AUTOMATIC ACTUATING MECHANISM FOR KEY-OPERATED MACHINES.

SPECIFICATION forming part of Letters Patent No. 685,427, dated October 29, 1901.

Application filed January 30, 1901. Serial No. 45,330. (No model.)

To all whom it may concern:

Be it known that I, DONALD MURRAY, a subject of the King of Great Britain, residing in the city of New York, county and State of New York, have made certain new and useful Improvements in Automatic Actuating Mechanism for Key-Operated Machines, of which the following is a specification.

My invention is an improvement upon the apparatus shown and described in my prior granted patent, No. 638,591, dated December 5, 1899, where I have shown a means for operating a type-writer or other type-machine automatically by means of a perforated paper tape, this tape being produced either locally or telegraphically by another machine.

The objects of the present invention are to do away with the cord connection between the type-writer and the automatic controlling mechanism and to substitute a simple and positive metallic coupling which is not affected by changes in the atmosphere, to obtain a smooth and therefore rapid cam action by providing means for setting the combs for the next letter while the last letter is in the act of being printed, to provide means for adjusting and instantly varying the force of the printing stroke of the type-bars, to provide an automatic brake acting at the end of each line or any predetermined point, and to provide means for putting more or less friction on the slotted "combs," so as to prevent the tendency to rebound and cause them to remain positively in the different positions to which they are shifted.

The accompanying drawings illustrate my invention.

Figure 1 is an end elevation of the improved machine embodying my invention. Fig. 2 is a front elevation of the same, partly broken away and showing the type-writer keys in section. Fig. 3 is a plan view sectioned on the lines A B, Figs. 1, 2, and 8. Fig. 4 is an enlarged view of the central portion of the plan shown in Fig. 3. Fig. 5 is a detail of Fig. 4, showing the means for putting more or less friction on the combs. Fig. 6 is a cross-section on the lines C D of Figs. 4 and 5. Fig. 7 is an end view and plan of one of the differently-slotted combs. Fig. 8 is an enlarged vertical

section of the machine on the lines E F, Figs. 2 and 3. Fig. 9 is an enlarged vertical section on the line G H, Fig. 3, showing the details of one of the cams. Fig. 10 is an enlarged view of the automatic brake mechanism, partly in section, as indicated by the line J K, Fig. 12. Fig. 11 is an end elevation of the brake mechanism. Fig. 12 is a cross-section of the brake mechanism on the lines L M, Figs. 10 and 11. Fig. 13 is a cross-section of the brake mechanism on the line O P, Fig. 12. Fig. 14 is an enlarged detail showing a front elevation, partly in section, of the metallic coupling between the automatic controller and the type-machine. Fig. 15 is a front elevation, partly in section, of a modified brake mechanism. Fig. 16 is a detailed section of the tape-carriage mechanism. Fig. 17 is a portion of the perforated controlling-tape.

The action of the improved mechanism is best seen in Figs. 8 and 9. There are a series of cross-bars 1 equal in number to the keys of the type-writer or other type-machine. They are pivoted at 2 on the piece c, attached to the frame of the machine b, and move in a slotted guide-bar 4. They are supported by a universal bar 5, which is controlled by a cam 6, Fig. 9. The cross-bars 1 are supported just clear of the combs 3. These combs, one of which is shown in end view and plan in Fig. 7, are differently slotted. Provision is made for their lengthwise motion to the extent of one tooth, or about one-sixteenth of an inch, on the bed e of the frame of the machine b. This motion takes place as the result of the pressure of the paper controlling-tape t against the ends of the rods 7, which project from the ends of the combs. When one or more of the combs 3 are moved under the action of the paper tape, the slots in the combs are so alined that any required cross-bar 1 and only one cross-bar at a time is at liberty to drop into the alined slots when the universal bar 5 moves away under the action of the cam 6, Fig. 9. The cross-bar 1 then moves forward under the tension of the spring 8. The type-writer or other type-machine is shown in dotted outline in Figs. 1, 2, and 8. In Fig. 8, 9 is a key of the type-machine pivoted at 10 and held up by a spring 11.

12 is the usual wire rod connecting the key to the type-bar of the type-writer. Folded over the key 9 and riveted to it at 14 is a thin metal plate 13. This is shown more clearly in section in Fig. 14. This double plate also carries two rivets 15 and 16. Hanging on rivet 16 is a small hook 17, which is held back between the two blades of the guide-piece 19, fixed to the end of the cross-bar 1 by spring 18, which is very much lighter and weaker than spring 8. Rivet 15 prevents hook 17 from jumping out of place. When under the action of the controlling-tape and the cams the cross-bar 1 moves forward into the alined slots in the combs, it throws the hook 17 forward under the universal bar 20 of the striker 21, the spring 8 being much stronger than the spring 18. The striker 21 is rigidly connected to the shaft 23, which is supported by the arms *d* of the framework *b*. To shaft 23 is also rigidly connected the arm 24, carrying the cam-roller 25, which engages in the groove of the cam 22, which is keyed to the revolving shaft 30. When the hook 17 has been thrown forward under bar 20, the cam 22 brings the striker 21 into action, thereby engaging the universal bar 20 with the hook 17 and positively depressing the key 9 of the type-writer or other type-machine. The moment the hook 17 has become engaged with the bar 20 the cam 6, Fig. 9, moves back the supporting-bar 5, which lifts the cross-bar 1 out of the alined slots in the combs and also frees the combs from the pressure of all the cross-bars. The moment this takes place the combs are free to move and the operation of resetting them for the next letter may proceed concurrently with the striking by striker 21 and cam 22 of the letter just selected. This is rendered possible, first, by the lower end of the connection 17 being made in the form of a hook adapted to lock into the rounded lower edge of the universal bar 20, and, second, by the hook 17 being arranged, as shown, so as to be affected by the forward motion, but not by the backward motion, of the cross-bar 1.

The arrangement described permits a better shape, and therefore smoother action and faster speed of operation, of the cam 22, because this cam under the new arrangement has no longer to finish its stroke while the cross-bar 1 is thrown forward, as was the case with the arrangement described in my prior patent, No. 638,591. The cam 6, Fig. 9, controlling the supporting-bar 5, has to act in about one-third of the total revolution of the shaft 30, and the cam 22 under the old arrangement had to act within the same period. This made the action of cam 22 rather abrupt. By allowing cam 22 to distribute its operation over the whole revolution of the shaft 30—a result rendered possible by the improved arrangement just described—the action is made much smoother, and greater speed of operation is thus possible.

To secure parallelism in the action of the supporting-bar 5, there are two cams like 6, Fig. 9. These are shown more clearly in Figs. 3 and 4. The supporting-bar 5 is carried by the rods 31, upon which are the short adjustable arms 28, held in position by lock-nuts and carrying at their ends the cam-rollers 29.

32 represents guide-posts for the rods 31. 33 represents also slotted guide-pieces for the supporting-bar 5. The bar 5 is covered with a strip of leather 58 to reduce the noise at the points where the bar comes in contact with the cross-bars 1.

Turning again to Fig. 8, the force of the blow for printing delivered by the striker 21 can be regulated for individual keys by the turnbuckles 34; but some practically instantaneous means for varying the force of the stroke of all the keys is required, because with the same force the printing is considerably lighter at a high speed of ninety or one hundred words a minute than it is at a low speed, such as forty or fifty words a minute. It is desirable, therefore, to have means of instantly varying the force of the printing impression in accordance with the speed. It is also desirable to be able to increase the force of the printing blow when manifolding. To accomplish this, I provide means for slightly raising or lowering the type-writer by means of a shaft and two small cams controlled by a handle 35. For this purpose the type-writer may be regarded as pivoted on the two back pillars 26. The tops of the two front pillars are bored out to take the short cylinders 36. These also rest in holes 37 in the feet of the type-writer, which usually hold rubber supporting-blocks. These rubber blocks are removed from the four feet of the type-writer and put under the base of the machine, as shown at 40 and 41. Through the frame, over the front feet of the type-writer, a hole is bored to carry a screw-bolt 42. This provides a permanent adjustment by raising or lowering the type-writer relatively to the cylinders 36. For quick adjustment by means of the handle 35 the cylinders 36 rest on small cams, shown in dotted outline, on the shaft 43 at the top of the front pillars 27. This cam mechanism is more clearly shown in Fig. 3. The two cams 44 are pinned to the shaft 43 and are operated by the handle 35. Raising or lowering the handle slightly raises or lowers the type-writer by raising or lowering the cylinders 36 and so increases or decreases the force of the printing impression.

The combs 3 have a tendency to rebound when the machine is operated rapidly. In order to understand this difficulty and the means taken to overcome it, a brief description must be given of the tape-feeding mechanism. This is shown in Figs. 1, 2, and 3. The paper controlling-tape *t*, Fig. 2, passes around the flanged guide-roller 45 in front of a perforated die-plate 46, around the flanged roller 47, around the sprocket-wheel 48, and

is finally thrown off by the shield 49 and falls into a basket or other suitable receptacle. The die-plate 46, the sprocket 48, and the shield 49 are attached to a carriage 50, which slides between V-plates 52 53, attached to the projection *f* of the framework *b* and reciprocates about a quarter of an inch under the control of the cam 54, Fig. 3, which is pinned onto the revolving cam-shaft 30. The cam-roller 55 is attached to the carriage 50, as shown in dotted outline in Fig. 3. The carriage as it moves inward carries the paper tape in front of the die-plate 46 up against the rods 7, attached to the ends of the combs 3, the rods 7 sliding in a small guide-block 56. The paper tape, in addition to a central row of perforations to engage with the sprocket-wheel, is punched on one side with holes arranged in various combinations, as shown in Fig. 17, so that when the tape is moved forward against the rods 7 some of the rods strike against the tape and others enter the holes in the tape and pass through into the holes in the perforated die-plate 46, as shown in Fig. 16. The rods, with their corresponding combs, are pushed back about one-sixteenth of an inch or the width of one tooth of the combs. In this way various slots in the combs are aligned and various cross-bars selected. The moment the cross-bars 1 are restored to their initial position by the supporting-bar 5 and the cams 6 the paper-carriage 50 moves outward and a thin plate attached to the carriage-block 57 engages with the teeth on the under sides of the rods 7, Fig. 7, and restores the combs to their initial position, ready to be set for the next letter. On the same shaft as the sprocket-wheel 48 is a ratchet-wheel, which when the carriage moves outward strikes against the fixed pawl 51, attached to the end of projection *f* of the framework *b*. This causes the sprocket-wheel to rotate and feed the tape forward a step. In Fig. 4 the details of the comb mechanism are clearly shown. The plates 59 and 60 limit the longitudinal motion of the combs, the distance between the ends of the combs and the plate 59 showing the total range of motion of the combs. The combs are held in place and move between rows of pins 61. The combs when suddenly moved against the plates 59 and 60 tend to rebound, thereby preventing the true alinement of the slots in the combs with the cross-bars 1. This difficulty is overcome by putting more or less friction on the combs. My improved arrangement for this purpose is shown in Figs. 4, 5, and 6. Adjustable slides 63 cross the bed of the machine immediately under the combs 3. These slides have lugs 64, through which pass screws 65. Pressing the slides up against the screw-heads is a spring 66. Each slide carries a row of five pins 67. By turning the screws 65 in or out the slides 63 are moved in or out and the rows of pins 67 put more or less pressure, and therefore friction,

on the combs, which are held up against this pressure by the stationary rows of pins 61. This arrangement only puts friction on the five inner combs. The two outside combs, the first and seventh, are capital and figure combs and are not operated directly by the tape, but by an intermediate mechanism which does not permit of their rebounding.

The brake mechanism for stopping the machine automatically at the end of a line is shown in Figs. 2 and 3, but more in detail in Figs. 10, 11, 12, 13, and 15. This brake mechanism is designed to be thrown into operation by a special group of perforations in the controlling-tape. This group of perforations operates, as do the other groups representing letters of the alphabet, by selecting one of the cross-bars 1 by the mechanism already described. This cross-bar throws under the striker-bar 20 the hook 17 of an extra key 68 on the type-writer which is not connected with a type-bar. Riveted to the key 68 is a plate 69, which projects downward.

70 is a pawl pivoted at 72 on the curved lever 73 and resting with its free end against the stop 71. This stop is shown in section in Fig. 15.

75 is a spring which tends to draw the lever over in the direction of the stop 71. One end of this spring is attached to the lever and the other end to the framework of the machine at 77, Figs. 2 and 3. The spring 78 keeps the pawl 70 up against the projection 86 of the stop 71. The lever 73 is U-shaped at its lower extremity, Fig. 13, and is pivoted at the points 76. On the shaft 30 is a coned friction-clutch 81. It is free to slide lengthwise on the shaft 30, but is prevented from revolving on the shaft by a key 95. (Shown in Fig. 13.) The coned portion of this clutch is adapted to fit a hollow cone in the block 80, which is screwed onto the frame of the machine. On the outer end of the clutch are ratchet-teeth which engage with corresponding ratchet-teeth on the small pinion 84, free to revolve on the shaft 30 and slightly reduced in diameter to prevent the pinion from slipping inward. The screw 85 prevents the pinion from slipping outward. On the clutch 81 is a groove in which slides a collar 82. The lever 73 is connected with this collar by the points of the two screws 83. Hence by moving the lever 73 outward the toothed portion of the clutch 81 can be thrown into engagement with the pinion 84, and when the lever 73 moves inward the clutch is freed from the pinion and the coned portion of the clutch engages with the hollow coned piece 80. A portion of the paper-carriage of the type-writer is shown in dotted outline at 79. The pinion is driven by the large gear-wheel 87 and the handle 88, Figs. 2, 3, and 8. When the necessary group of perforations on the controlling-tape has caused the key 68 to be depressed, the plate 69 strikes the pawl 70, throwing it down out of engagement with the

stop 71. The lever 73 then flies inward under the action of the spring 75. The clutch 81 is disengaged from the pinion 84 and the coned portion of the clutch is wedged into the hollow coned piece 80 and the revolving shaft 30 is rapidly brought to a stop, the key 95 preventing the shaft from revolving in the clutch 81. When the machine is stopped in this way, the operator runs the type-writer carriage back and the end of the carriage strikes the top of the lever 73, as shown at 79. The lever throws the clutch out of engagement with the hollow cone 80 and into engagement with the pinion 84. At the same time the pawl 70 rises into its place at the stop 71, and the machine is ready to start again as soon as the gear-wheel 84 is rotated. In Fig. 10 the clutch is engaged with the pinion 84 and in Fig. 12 it is engaged with the hollow cone 80. There are various devices available as brakes. For instance, a coned friction-brake may be applied direct to the shaft 30 without previous disengagement from the pinion 84; but arrangements of this kind, which abruptly stop the pinion and driving-wheel, jar the motive power and prevent running the machine at a high speed up to the end of each line. By the arrangement illustrated in this application, if manually operated, when the brake acts the operator suddenly feels the driving-wheel free and there is no unpleasant shock to the hand. The friction of the two cones 80 and 81 is also the best possible way of rapidly absorbing the energy of and stopping the revolving shaft 30 with its cams, their inertia being quite considerable, as the speed of the shaft may equal ten revolutions per second. The arrangement has also the advantage that the machine is set going again by the single act of running the type-writer carriage back, an operation that has to be performed in any case.

In Fig. 15 is shown a modification of this brake mechanism required when the machine is run by power instead of by hand. Preferably a small shunt-wound electric motor is used. The shaft and pinion of such a motor are shown at 89, Fig. 15. The pinion gears into a larger wheel 90, which on its inner side carries a hollow cone 91. The clutch 81 in this case is double-coned to ease the starting as well as the stopping. The action is the same as in the preceding case. The motor being shunt-wound, the action of the brake in throwing the load on and off does not materially affect the speed of the motor.

In order to conveniently remove the combs for cleaning and oiling, I have provided a cam-bar 92, pivoted at each end at 94 and capable of being rotated by the lever 93, Fig. 3. Upon turning the lever the cam-bar throws out the cross-bars 1 and allows the combs to be easily removed.

What I claim, and desire to secure by Letters Patent, is—

1. In an actuating mechanism for key-operated machines the combination with a key-bar of a continuously-rotating motor-driven shaft therefor and a mechanical coupling between said shaft and said key-bar formed of two separable pivoted sections with means for engaging and disengaging said sections. 70

2. In an actuating mechanism for key-operated machines, the combination with a series of key-bars of a motor-driven shaft, a reciprocating universal bar operated thereby, a series of jointed, rigid, mechanical couplings between said bar and the respective key-bars, means for engaging and disengaging any coupling with said bar and a suitable device for determining the desired coupling to be employed. 75 80

3. In an actuating mechanism for key-operated machines the combination with a series of key-bars of a motor-driven shaft, a continuously-reciprocating, universal bar operated thereby, a series of hooked links for coupling said bar and the respective key-bars, a pivoted cross-bar for each such hook to engage the hook when moving in one direction only and means for selecting any single required cross-bar to be employed. 85 90

4. In an actuating mechanism for key-operated machines the combination with a series of key-bars of a motor-driven shaft and a series of jointed, rigid, mechanical couplings between said shaft and key-bars, a cross-bar for each coupling, and means for selecting and operating any given cross-bar and coupling; said means consisting of a series of differently-slotted, endwise-movable combs, and a perforated tape backed up by a reciprocating perforated die-plate. 95 100

5. The combination of a type-bar machine, an automatic actuating device therefor, means for engaging any type-bar with its corresponding member of the actuator and means for adjusting the distance between the type-bar mechanism and the actuating mechanism consisting of a cam-surface upon which the type-bar mechanism is supported. 105 110

6. The combination in an actuating mechanism for key-operated machines of a motor-driven shaft, a series of independent, key-operating devices, and means for automatically disconnecting the driving-shaft and the motor. 115

7. The combination in an actuating mechanism for key-operated machines of a motor-driven shaft, a series of independent, key-operating devices, and means for automatically disconnecting the driving and driven parts, and applying a friction-brake to the driven part. 120 125

8. The combination in an actuating mechanism for key-operated machines of a motor-driven shaft, a series of independent key-operating devices, means for automatically disconnecting the driving and driven parts by throwing into action an independent operating device and said disconnecting device. 130

9. The combination in an actuating mechanism for key-operated machines of a motor-driven shaft, a series of type-bars means for coupling any type-bar and said shaft and a
5 selecting device, including a series of cross-bars, a group of differently-slotted combs having longitudinal movement and means for adjustably applying friction to the surface of said combs to prevent rebounding.

DONALD MURRAY.

Witnesses:

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ANNA M. DONLEVY.

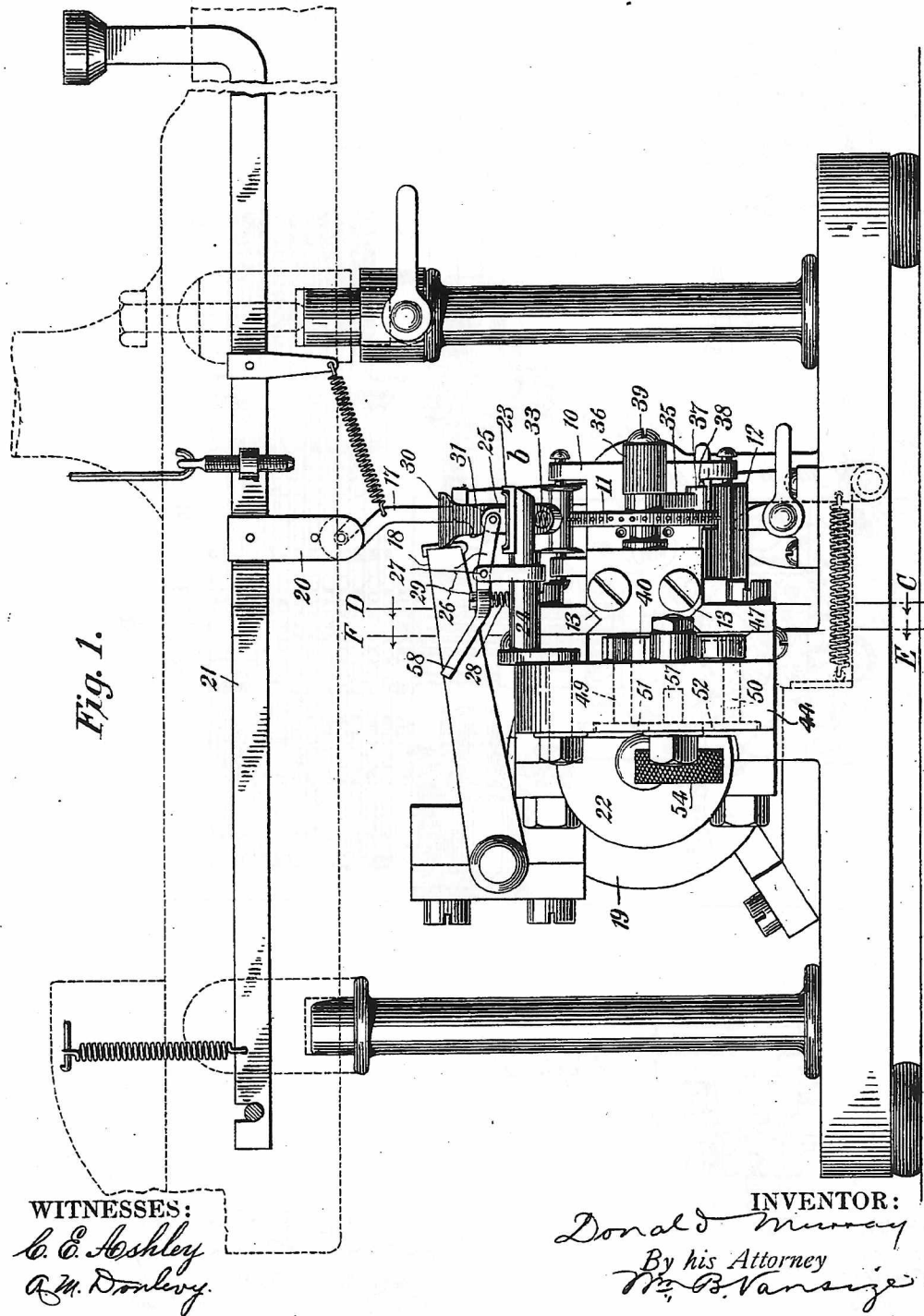
Patented Apr. 29, 1902.

ACTUATING MECHANISM FOR KEY OPERATED MACHINES.

(Application filed June 20, 1901.)

(No Model.)

3 Sheets—Sheet 1.



THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

No. 698,845.

Patented Apr. 29, 1902.

D. MURRAY.

ACTUATING MECHANISM FOR KEY OPERATED MACHINES.

(Application filed June 20, 1901.)

(No Model.)

3 Sheets—Sheet 2.

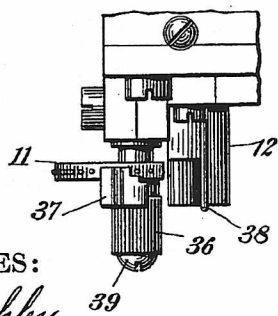
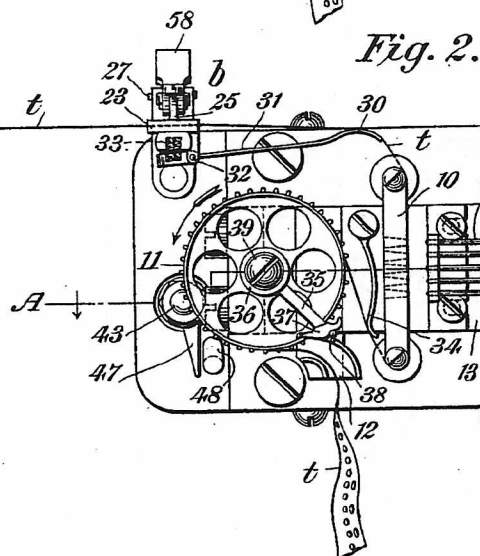
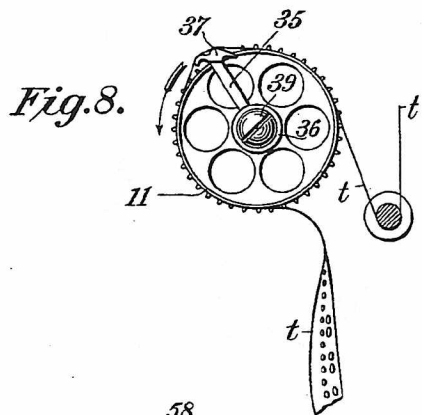
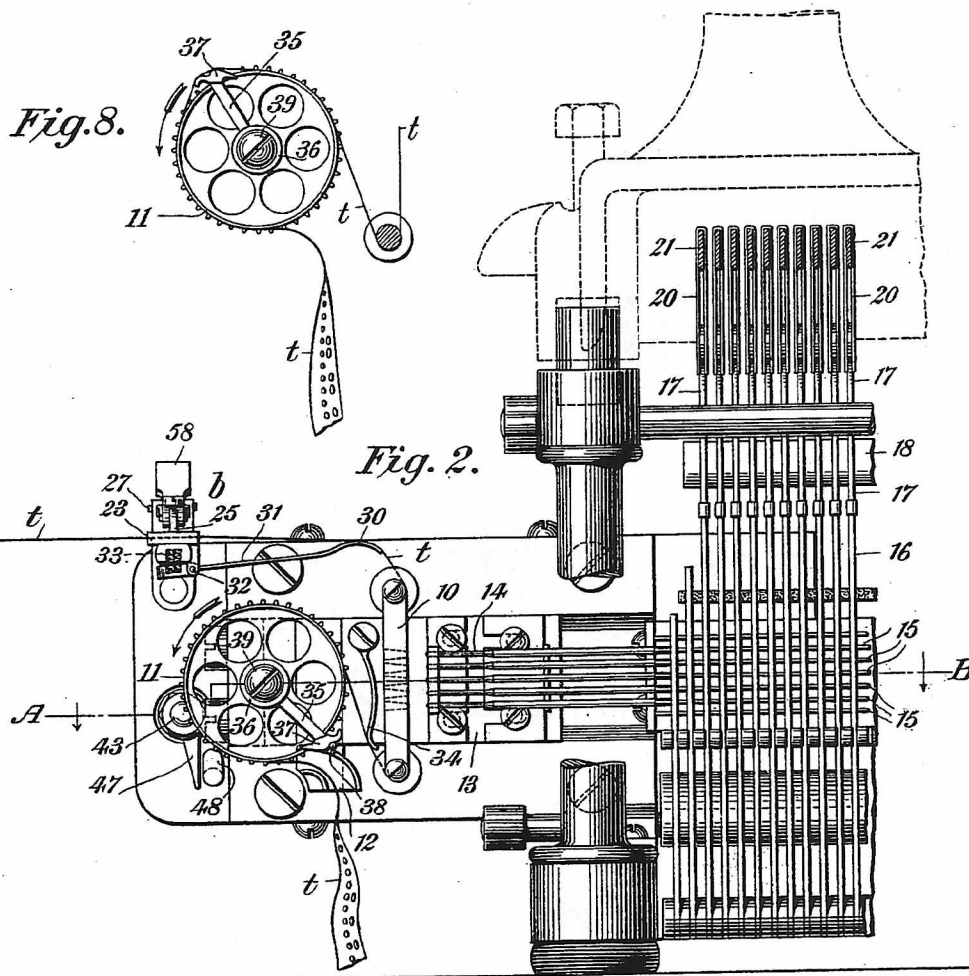


Fig. 3.

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No. 698,845.

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ACTUATING MECHANISM FOR KEY OPERATED MACHINES.

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Fig. 4.

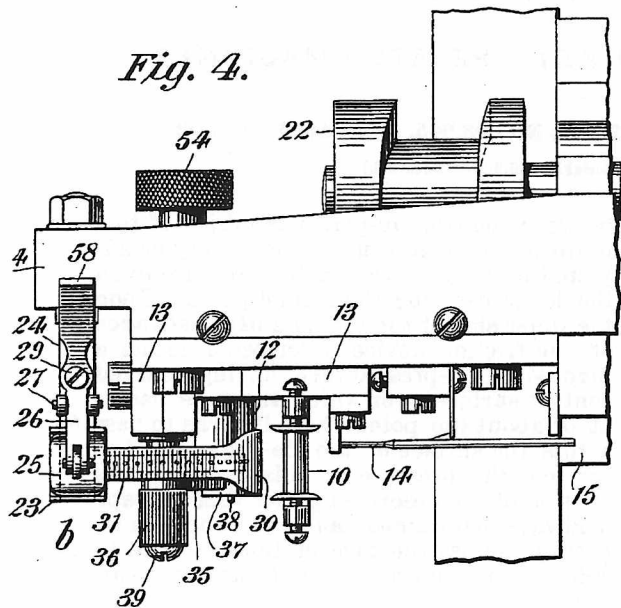


Fig. 6.

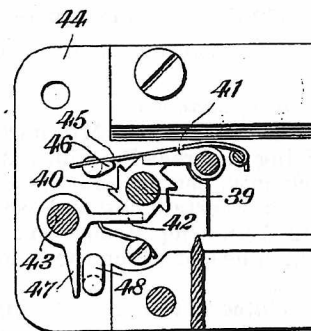


Fig. 7.

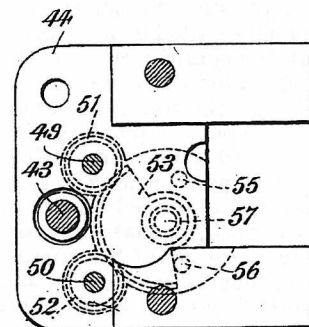
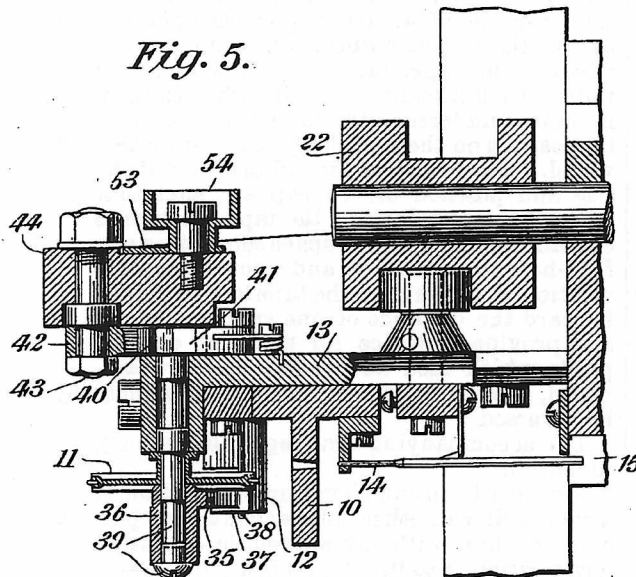


Fig. 5.



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INVENTOR:

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UNITED STATES PATENT - OFFICE.

DONALD MURRAY, OF NEW YORK, N. Y.

ACTUATING MECHANISM FOR KEY-OPERATED MACHINES.

SPECIFICATION forming part of Letters Patent No. 698,845, dated April 29, 1902.

Application filed June 20, 1901. Serial No. 65,253. (No model.)

To all whom it may concern:

Be it known that I, DONALD MURRAY, a subject of the King of Great Britain, residing in New York city, county and State of New York, have made certain new and useful Improvements in Actuating Mechanism for Key-Operated Machines, of which the following is a specification.

My invention relates to that class of apparatus in which a perforated tape controls the position of a series of levers actuated by a suitable motor, and thus operates a typewriter or type-setting machine, such as that shown and described in my United States Letters Patent No. 638,591, dated December 5, 1899, and also in my pending application, filed January 30, 1901, Serial No. 45,330. In the latter case I have shown a series of slotted reciprocating bars, called by me "combs." The terminals of the combs are pointed and register with perforations in a reciprocating die-plate. Between the die-plate and the comb-terminals a paper strip or tape is fed along step by step, and when perforations in the tape register with perforations in the die-plate and the plate is advanced one or more of the combs are moved, so that a certain series of the slots in the edges of the combs are caused to arrange themselves in line to permit the movement of one of a series of cross-bars, which by suitable mechanism causes the corresponding key of the type-writing or type-setting machine to be operated.

The object of the present invention is to provide means for maintaining a suitable tension upon the paper tape or strip, to provide means when occasion requires for causing a group of perforations in the tape representing one letter to register with the appropriate perforations in the die-plate, and to provide means for reversing the direction of feed of the paper strip when emergency demands that a portion of the tape be again passed across the die-plate.

I pass the tape through a special tension device consisting of a channeled friction-plate with a corresponding friction-plate pivotally supported upon the end of a spring-pressed lever, the second friction-plate being located between the flanges of the channeled friction-plate, so that the paper strip passing

between the friction-plates is subjected to a uniform frictional control, which may be adjusted by varying the spring-pressure upon the lever carrying the second plate. Upon the inner side of the tape slightly in advance of the friction device described I locate a pivoted spring-pressed lever having a curved contact-surface over which the tape passes at or about the point where it turns to pass across the surface of the die-plate, and I so arrange the pressure of this lever and the friction of the described plates that the tape is always maintained taut and smooth in its passage across the face of the die-plate in spite of the reciprocations of the paper-carriage.

To feed the tape forward a subdivision of a letter at a time, I provide a rotating shuttle consisting of an arm supported upon the axis of the sprocket-wheel, which operates to advance the paper tape. On the end of the radial arm is a small cap, which when the arm is rotated under runs the tape, lifting it from its position on the periphery of the sprocket-wheel. The length of the radial arm and the size and position of the cap are such that when the cap under runs the tape the tape is extended and moved the space separating one feed-hole from another, and upon a complete rotation of the shuttle the tape is thus moved forward the distance of one subdivision. I also provide a device for throwing out the pawls which feed and retain the sprocket-wheel, so that the direction of rotation may be reversed.

The accompanying drawings illustrate my invention.

Figure 1 is an end elevation of a section of a type-writer or other independent key-operated machine with my automatic actuating device applied to it. Fig. 2 is a front elevation showing the tape-feeding mechanism. Fig. 3 is a detail view of the rotating shuttle. Fig. 4 is a plan view of the tape-feeding mechanism. Fig. 5 is a section of the same on the line A B, Fig. 2. Fig. 6 shows the holding and propelling pawls, the view being taken on the line C D, Fig. 1. Fig. 7 is a section of the same on the line E F, Fig. 1; and Fig. 8 shows the rotating shuttle in its movement to advance the paper.

The paper tape *t* passes through the tension device *b* across the face of the die-plate 10, around the sprocket-wheel 11, and out through the guide 12. The die-plate 10 is attached to the reciprocating carriage 13. The carriage is operated by the cam 22 and serves to carry the paper tape and die-plate 10 into engagement with the terminals 14 of the series of slotted bars or combs 15. The result of this is that one or more of the combs 15 are moved so that a certain series of the slots are brought into alinement, and one of the cross-bars 16 moves forward into the alined row of slots in the combs and throws forward a corresponding hook 17 into position to be struck by the universal bar 18. This bar reciprocates under the action of the cam 19, Fig. 1, and the hook 17 is thus depressed, and the type-writer key 21 is operated by reason of its connection with the hook 17 through the strap 20.

The improved tension device *b* consists of a fixed channeled friction-plate 23, supported on a post 24, which is bolted to the frame of the machine. A second friction-plate 25 rests within the channeled plate 23 and is pivotally supported upon the lever 26, pivoted at 27. The friction-plate 25 under the influence of the spring 28 is pressed against the friction-plate 23. The spring 28 is adjustable by means of the screw 29. The paper strip passes between the two plates 23 and 25 and thence over the curved end 30 of the lever 31, pivoted at 32, the terminal 30 being forced upward by the spring 33. It is desirable to so adjust the tension of the tape *t* as it passes between the friction-plates 23 and 25 that it will yield readily to the propelling movement of the sprocket-wheel 11, while the tension exerted by the lever 31 will serve to maintain the tape taut during the passage across the face of the die 10. The friction of the plates 23 and 25 on the tape *t* must be sufficient to prevent it being pulled forward by the spring-arm 31, which would then be free to fly upward to its limit, in which position it would be unable to exert enough tension on the tape to keep it taut in front of the die-plate. The tape is threaded through the tension device by depressing the end 58 of the lever 26, which raises the plate 25 from the plate 23, thus allowing the tape to be slipped in from the side. The mode of operation of this tension device is obvious from the description just given. With a simple friction device without the spring-arm 31 the tape is kept taut against the die-plate 10 during the inward movement of the reciprocating carriage 13; but as soon as the outward movement begins the tape bags and forms a loop in front of the die-plate and is not drawn back clear from the terminals 14. The result is that when sprocket 11 rotates the tape is torn. The spring-arm 31, combined with the friction device, prevents this and insures true alinement of the holes in the perforated tape with the holes in the

die-plate. It also checks any tendency on the part of the sprocket-wheel 11 to overfeed.

34 is an adjustable guide for the paper strip.

The rotating shuttle is composed of a radial arm 35, fixed to a sleeve 36 on the shaft 39 of the sprocket-wheel 11. On the free end of the arm 35 just outside the periphery of the sprocket-wheel 11 is a cap 37, which projects across the periphery of the sprocket-wheel 11, as shown in Fig. 3, and which under-underruns the tape when the radial arm is moved from its position of rest by applying finger and thumb to the knurled sleeve 36. A piece of spring-wire 38, fixed at one end to the carriage 13 and projecting outward, engages a depression in the cap 37 and holds it in a position of rest when not in use. In its normal position when retained by the spring-wire 38 the cap 37 completes the outline of the paper-guide 12.

Under ordinary circumstances the paper tape *t*, as the result of the combined action of the reciprocating paper-carriage 13, the sprocket-wheel 11, the ratchet-wheel 40, and the pawl 42, is moved forward in front of the die-plate 10 one letter-space at a time. Each letter-space consists of five subdivisions corresponding to the central feed-holes in the paper tape, which engage with the teeth of the sprocket-wheel 11. Consequently to advance the tape one subdivision of a letter all that is necessary is to lift the tape from one tooth to the next adjoining one on the sprocket-wheel. This process one or more times repeated is necessary when starting the tape to bring the letter-divisions into proper alinement with the five holes in the die-plate 10. It is accomplished by turning the shuttle one complete rotation for each subdivision of a letter till proper alinement is attained, which must necessarily be reached in not more than five throws of the shuttle. The operation of the shuttle in lifting the tape is best seen in Fig. 8.

The mechanism for enabling the tape to be pulled back whenever desired is as follows: The shaft 39, Fig. 6, the ratchet 40, and the holding-pawl 41 are located on the underside of the carriage 13. When the carriage 13 moves outward, the ratchet 40 is brought into engagement with the propelling-pawl 42, which is carried by the stud 43, fixed on the frame 44 of the machine. When it is desired to rotate the tape backward, it is necessary to throw the pawls 41 and 42 out of engagement with the ratchet 40, which is attached to the same spindle 39 as the sprocket-wheel 11. For this purpose there is attached to the pawl 41 a metal strip 45, which normally rests upon a small cam 46. The propelling-pawl 42 has a projecting finger 47, which rests in position to be operated by a second small cam 48. The two cams 46 and 48 are attached, respectively, to two shafts 49 and 50, which project through the frame

44 and are furnished with gear-wheels 51 and 52. (Shown in dotted outline in Fig. 7.) These gear-wheels engage with a segmental gear 53. (Also shown in dotted outline in Fig. 7.) This gear 53, which is fixed to the shaft 57, is rotated by means of the milled head 54, Figs. 4 and 5, between the fixed limiting-stops 55 and 56. By turning the milled head to the right the pawls 41 and 42 are thrown out of engagement with the ratchet 40. The sprocket-wheel is then free to move in either direction and the tape may be pulled back by hand to any point desired.

What I claim, and desire to secure by Letters Patent, is—

1. The combination in actuating mechanism for key-operated machines of a perforated tape, a sprocket-wheel for advancing said tape, a suitable die-plate, a friction device consisting of a pair of spring-pressed plates between which the tape passes and a lever making yielding contact with said tape at a point between said friction device and wheel.

2. The combination in actuating mechanism for key-operated machines of a perforated controlling-tape, a sprocket-wheel for advancing the tape, a suitable die-plate, a friction device to restrain the tape and a spring-pressed lever to hold the tape taut.

3. The combination in the described mechanism of a sprocket-wheel, a perforated tape, and a rotating shuttle device in position to underrun the tape and vary its position on the wheel.

4. The combination in an actuating mechanism for key-operated machines of a perforated controlling-tape, a sprocket-wheel, a die-plate, and means for stepping the tape along the space between two successive perforations consisting of a radial arm on the wheel-shaft and a cap on said arm in position to underrun the tape.

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Witnesses:

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No. 710,163.

Patented Sept. 30, 1902.

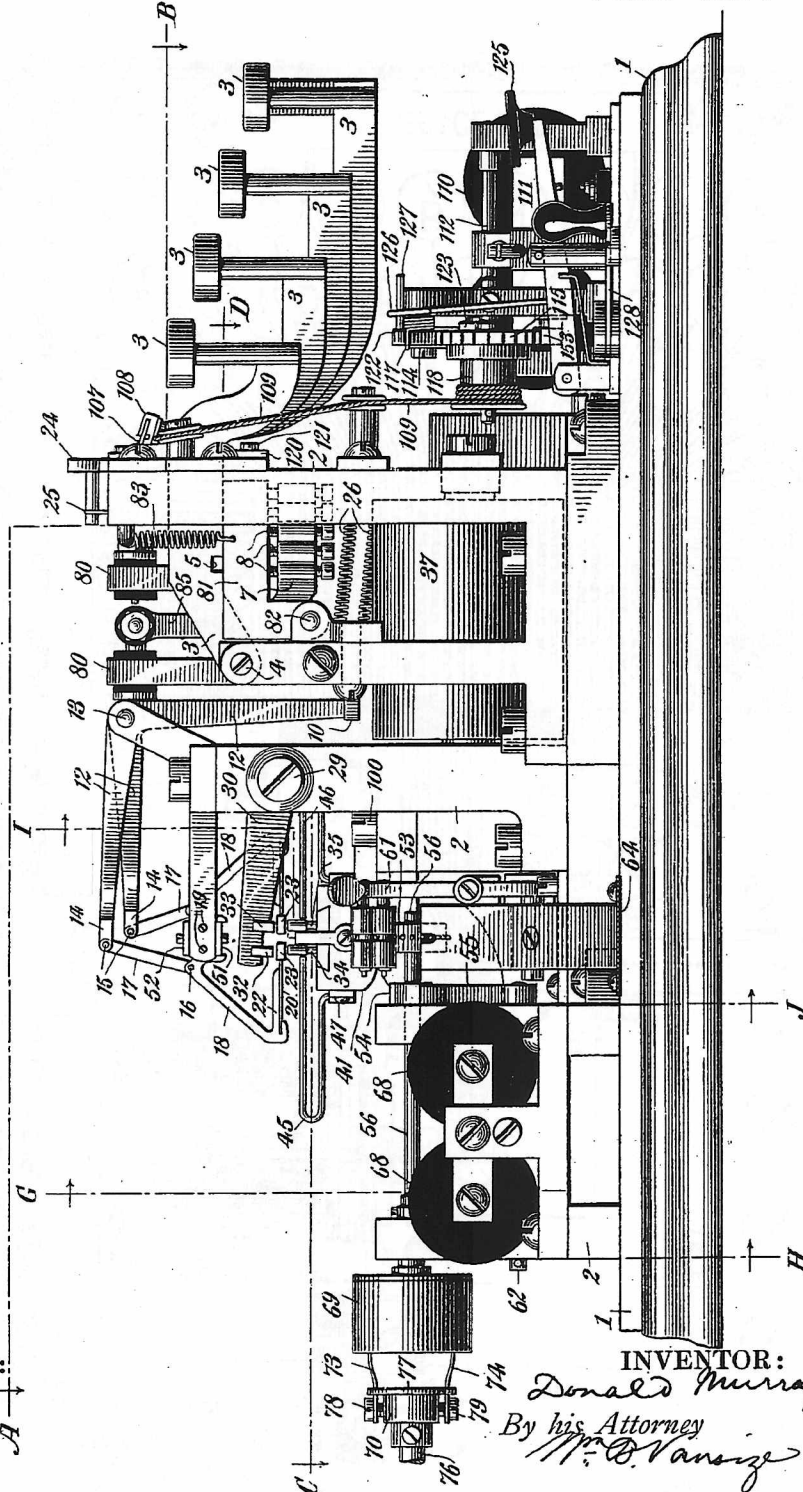
D. MURRAY.
KEYBOARD PERFORATOR.

(Application filed July 20, 1901.)

(No Model.)

9 Sheets—Sheet 1.

Fig. 1.



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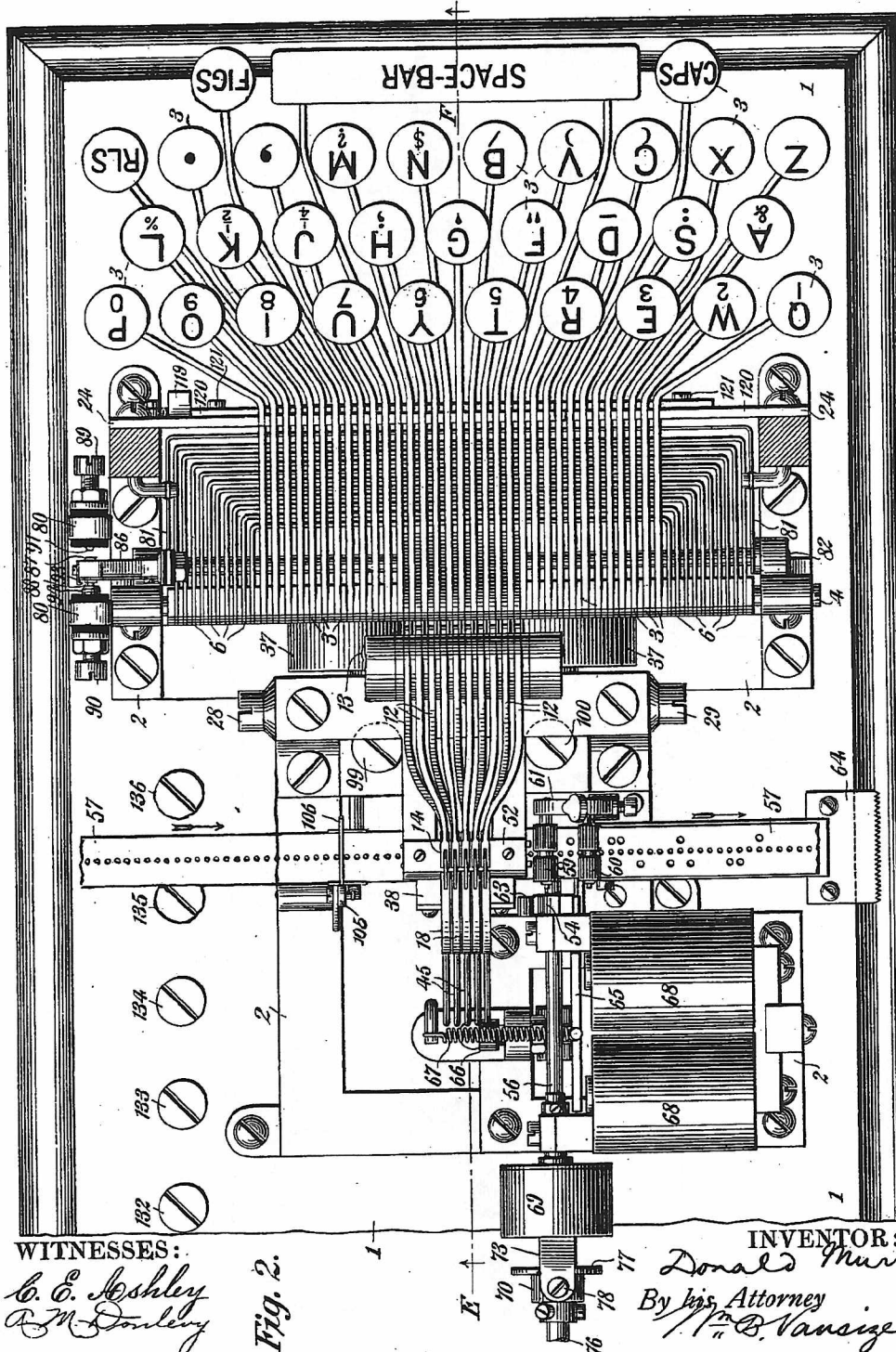
Patented Sept. 30, 1902.

D. MURRAY.
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(Application filed July 20, 1901.)

(No Model.)

9 Sheets—Sheet 2.



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Fig. 2.

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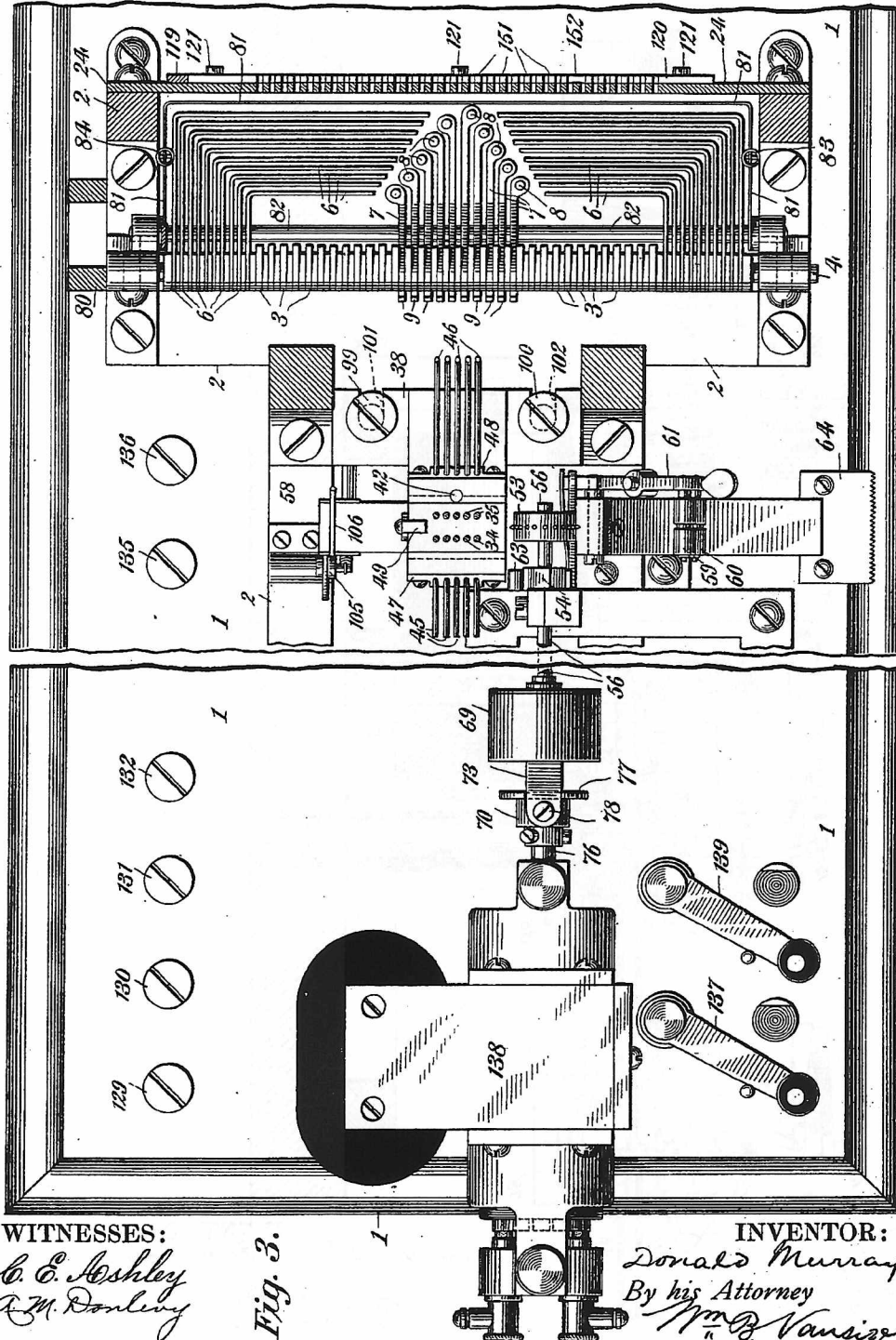
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D. MURRAY.
KEYBOARD PERFORATOR.

(Application filed July 20, 1901.)

(No Model.)

9 Sheets—Sheet 3.



No. 710,163.

Patented Sept. 30, 1902.

D. MURRAY.
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(Application filed July 20, 1901.)

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Fig. 4.

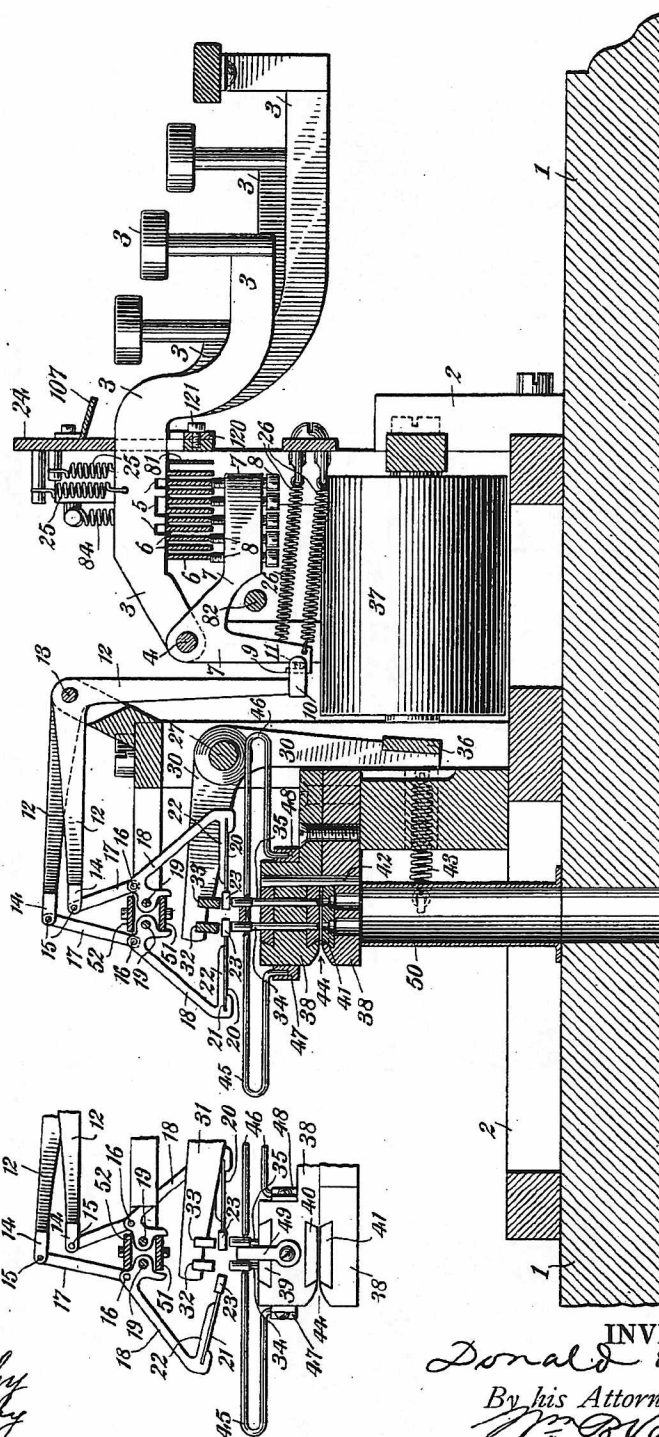


Fig. 5.

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(No Model.)

9 Sheets—Sheet 5.

Fig. 6.

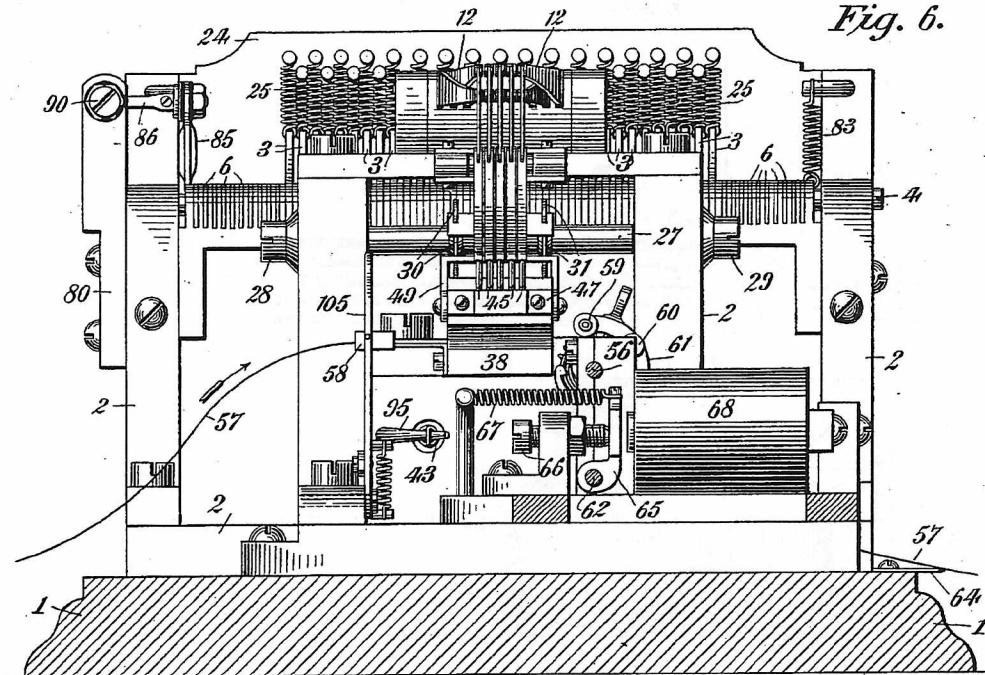
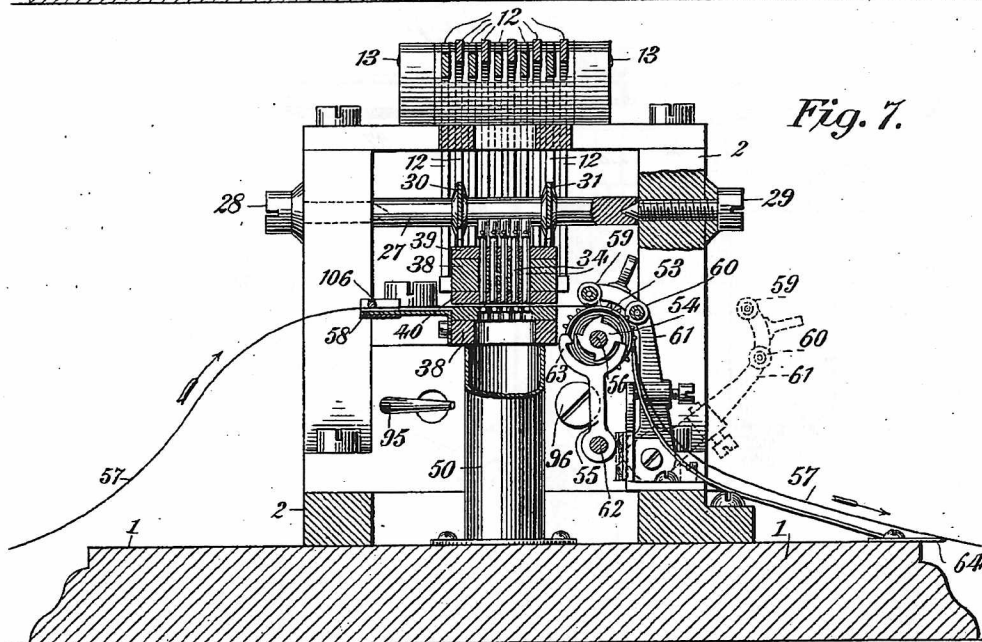


Fig. 7.



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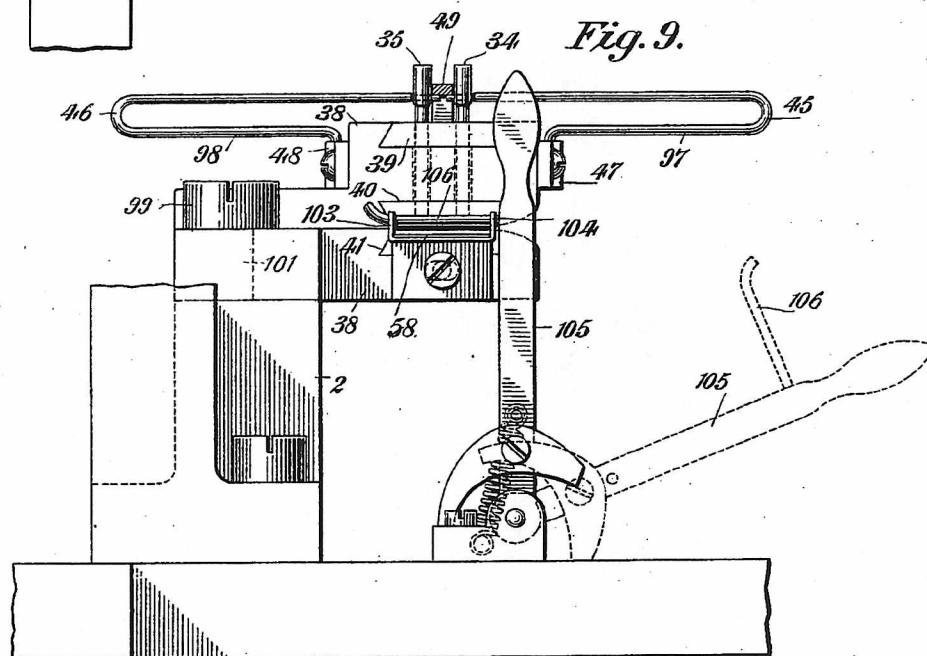
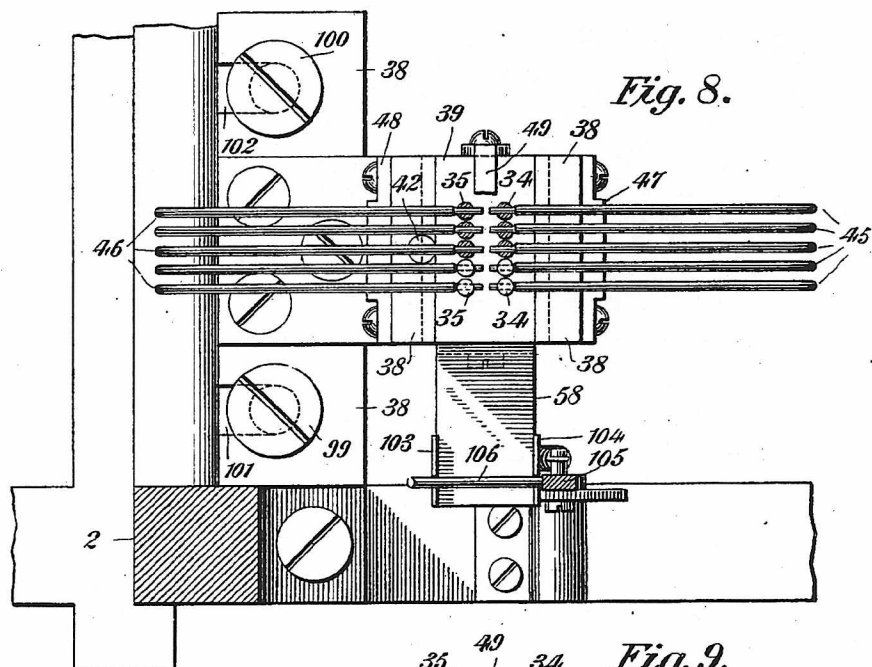
No. 710,163.

Patented Sept. 30, 1902.

D. MURRAY.
KEYBOARD PERFORATOR.
(Application filed July 20, 1901.)

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9 Sheets—Sheet 6.



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(Application filed July 20, 1901.)

(No Model.)

9 Sheets—Sheet 7.

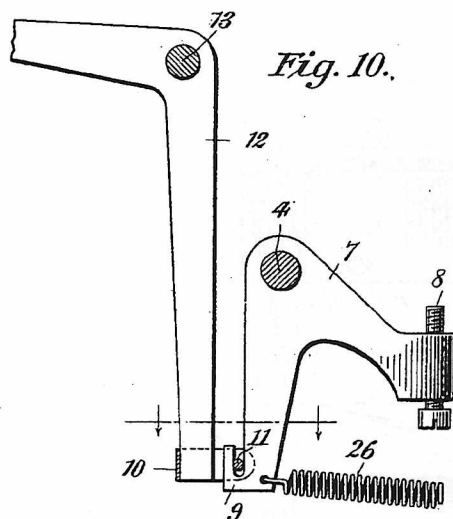


Fig. 10.

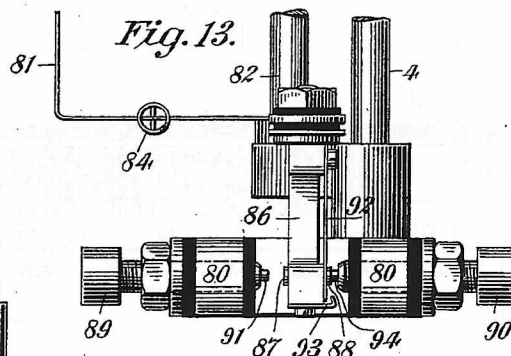


Fig. 13.

Fig. 11.

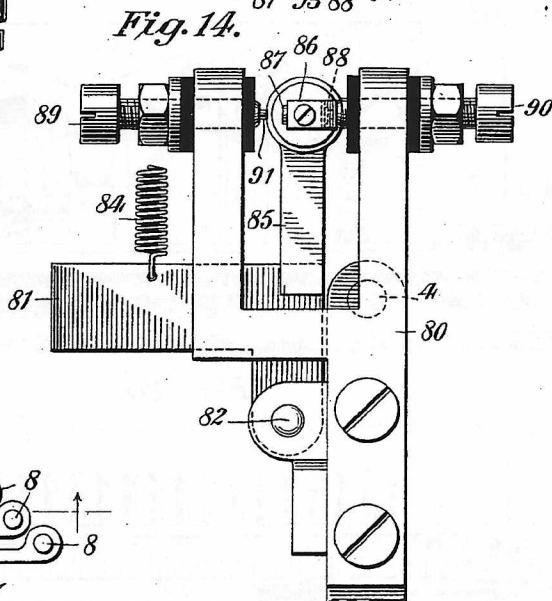
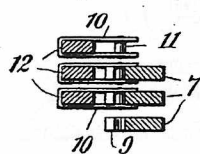


Fig. 14.

Fig. 12.

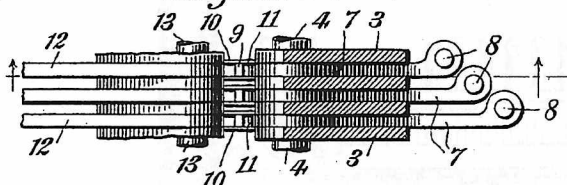
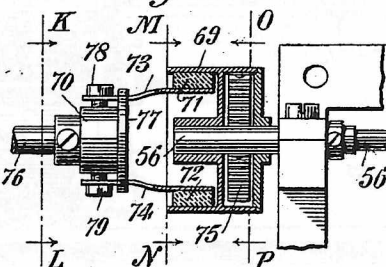
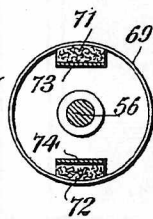
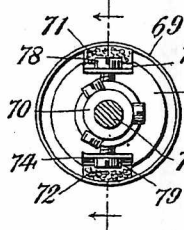


Fig. 15.

Fig. 16.

Fig. 17.

Fig. 18.



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No. 710,163.

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D. MURRAY.
KEYBOARD PERFORATOR.

(Application filed July 20, 1901.)

(No Model.)

9 Sheets—Sheet 8.

Fig. 19.

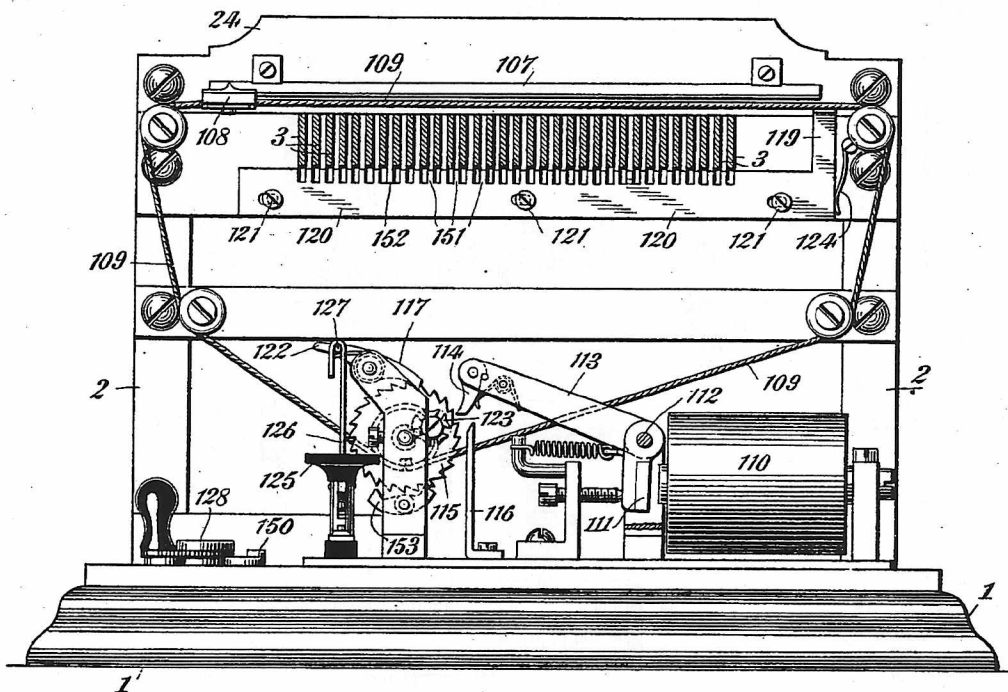
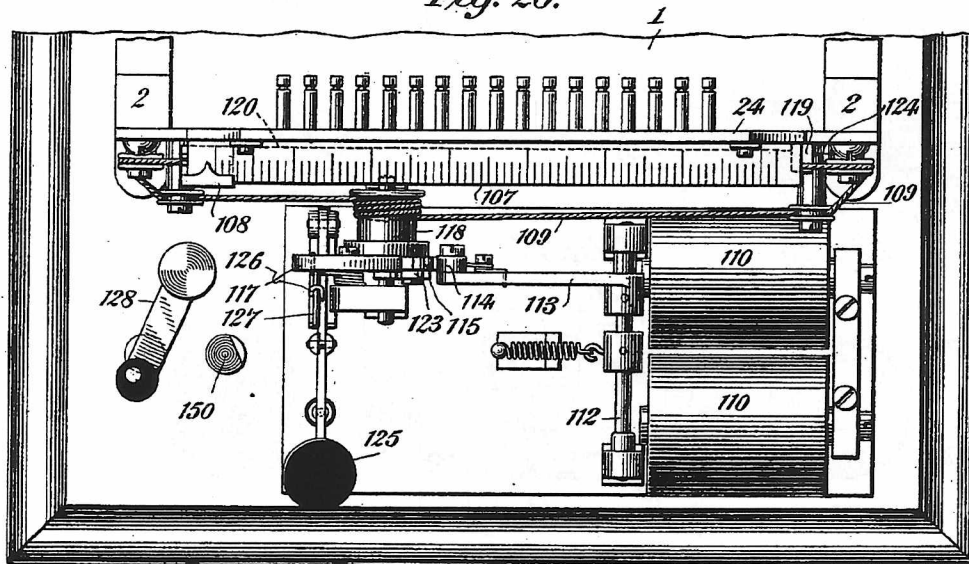


Fig. 20.



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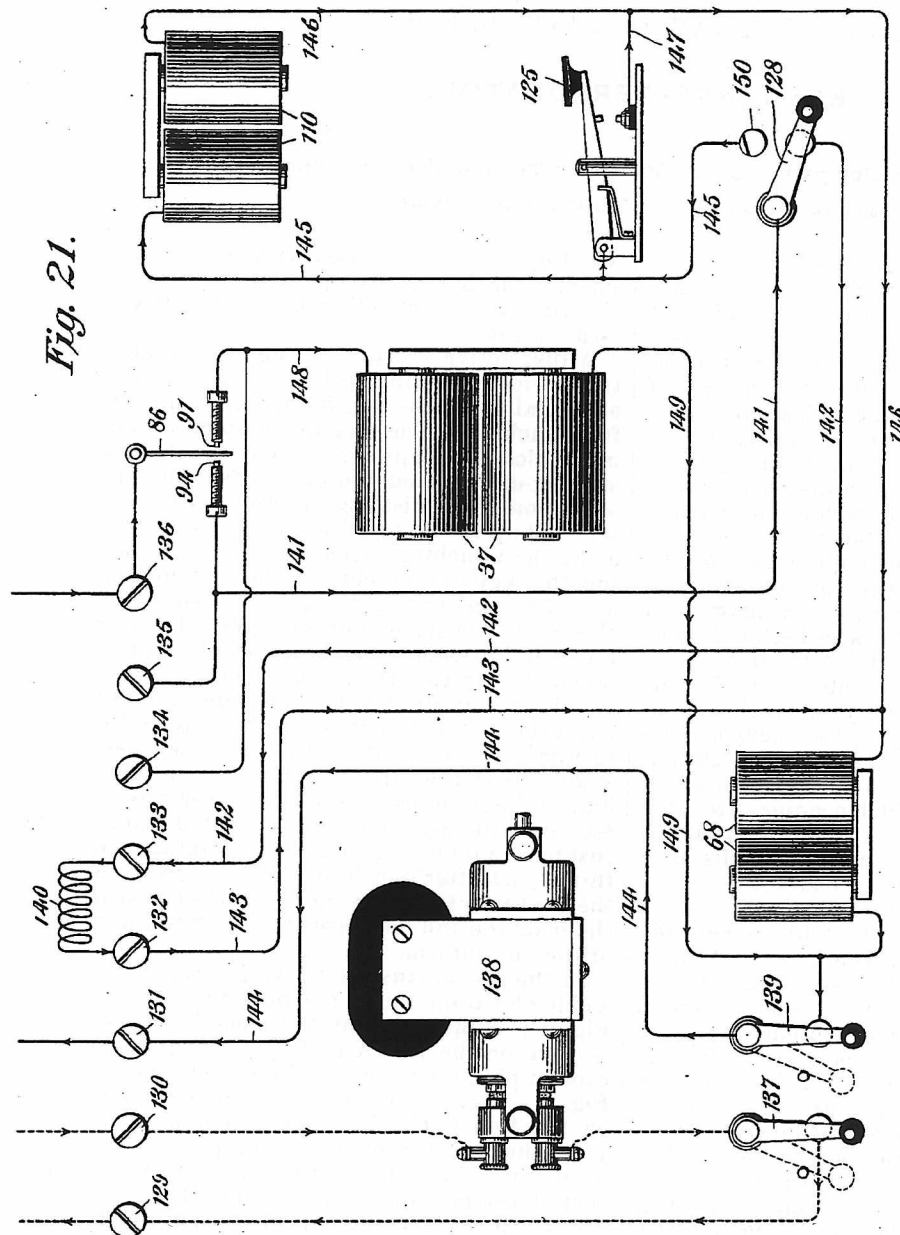
No. 710,163.

Patented Sept. 30, 1902.

D. MURRAY.
KEYBOARD PERFORATOR.
(Application filed July 20, 1901.)

(No Model.)

9 Sheets—Sheet 9.



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UNITED STATES PATENT OFFICE.

DONALD MURRAY, OF NEW YORK, N. Y.

KEYBOARD-PERFORATOR.

SPECIFICATION forming part of Letters Patent No. 710,163, dated September 30, 1902.

Application filed July 20, 1901. Serial No. 69,041. (No model.)

To all whom it may concern:

Be it known that I, DONALD MURRAY, a subject of the King of Great Britain, residing in New York city, county and State of New York, have made certain new and useful Improvements in Keyboard-Perforators, of which the following is a specification.

My invention relates to mechanism for the production, by means of the ordinary type-writer keyboard, of a perforated paper tape or strip, such as is used in various systems of automatic telegraphy, but more especially in connection with the modification of the Wheatstone automatic transmitter employed in the printing-telegraph system shown and described in my United States Letters Patent Nos. 653,934, 653,935, and 653,936, dated July 17, 1900, and No. 670,964, dated April 2, 1901. One characteristic of said system is that it employs an alphabet in which the letters or characters are of equal length, and the present improvements are arranged to produce groups of perforations each of which occupies the same length or distance on the tape. The tape is therefore fed along the same total distance or length for each letter or character.

The objects of my invention are, first, to provide a more simple and reliable paper-feed than can be employed where the letters or characters are of varying length; second, to provide a paper-feed in which such feed step is divided into substeps or sections; third, to provide simpler and quicker-operating selecting and punch-actuating devices than heretofore, and, fourth, to provide for automatically blocking the operation of the key-levers after a predetermined number of letters or spaces have been perforated.

I prefer to employ an ordinary keyboard, like a type-writer keyboard. Each key is a selecting device designed to operate one or more of a series of "fiddle-bows," which control a series of small punch-blocks. These are automatically inserted and withdrawn at points between a universal striker-bar and a gang of punches in a die-block, through which the paper tape is passed in the process of perforation. The paper-feed is driven by a constantly-operating motor. The motor-driven shaft is connected to the sprocket-wheel shaft by a friction-clutch and a helical spring. The punching is done by an electromagnet

which operates a universal striker-bar. The spacing mechanism is operated by another electromagnet controlling the motor-driven escapement.

A distinctive feature of the invention is the method of feeding the tape. There are two electrical contacts—one for spacing and one for punching. The spacing-contact is normally closed. Depressing a key breaks the spacing-circuit, and the tape is fed forward a fraction of the distance allowed to each letter. The punching-contact then closes, operating the punching mechanism. On releasing the key the punching-circuit is broken and the spacing-circuit again closed. The closing of the spacing-circuit feeds the tape forward the remaining fraction of the distance allotted to each letter. The advantage of this arrangement is that it divides into two parts the distance that the tape has to be fed forward for each letter—that is to say, assuming that the tape has to be fed forward half an inch for each letter then the tape is fed forward, say, one-third of that distance just before punching and the remaining two-thirds just after punching. This division of the feed into two steps increases the speed of the machine and decreases the wear and tear of the mechanism.

In the accompanying drawings, Figure 1 is a side elevation of the perforating-machine. Fig. 2 is a plan view of the same, partly in section, on the line A B, Fig. 1. Fig. 3 is a broken plan view sectioned on the line C D, Fig. 1. Fig. 4 is a side elevation sectioned on the line E F, Fig. 2. Fig. 5 is a detail view showing the operation of part of the mechanism in Fig. 4. Fig. 6 is a cross-section of the machine on the line G H, Fig. 1. Fig. 7 is a cross-section on the line I J, Fig. 1. Figs. 8 and 9 are enlarged detail views showing the punches and die-block, in plan in Fig. 8 and in elevation in Fig. 9. Figs. 10, 11, and 12 are enlarged detail views of part of the selecting mechanism. Figs. 13 and 14 are enlarged detail views, in plan and side elevation, of the punching and spacing contact-points and the arrangements connected therewith. Figs. 15, 16, 17, and 18 are detail views of the combined spring and friction coupling between the shaft of the motor shown in Fig. 3 and the shaft carrying the spacing-ratchet

and sprocket-wheel. Fig. 19 is a front elevation of the lever-locking device, and Fig. 20 is a plan view of the same. Fig. 21 is a diagram showing the electrical connections of the

5 perforator.

Referring to Fig. 4, the machine consists of a base 1, to which is attached a metal framework 2, which supports the magnets, keys, selecting device, and other mechanism. The
10 keys 3 are pivoted on the rod 4 and normally held upward against the bar 24 by the springs 25. On the under part of each key different arrangements of slots 5 are cut. When a key is depressed, this slotted portion selects and
15 depresses one or more of the fiddle-bows 6. (See Figs. 2 and 3.) Pivoted on the same shaft 4 as the keys and arranged alternately with them, as shown in Fig. 3, are a series of levers or "kickers" 7, whose number depends
20 on the maximum number of holes that it may be desired to punch in the tape within any letter-space of the alphabet employed. In the drawings the invention is shown with ten kickers, this being the number required for
25 the printing-telegraph system described in my said prior granted patents. The kickers are adjustable relatively to the fiddle-bows by means of the set-screws 8 and are pressed upward against the fiddle-bows by the springs
30 26. At the other end of the kickers there is a hook 9, (most clearly seen in Figs. 10, 11, and 12,) which engages with a strap 10 and rivet 11, attached to the lower end of the bell-crank levers 12, which are pivoted on the
35 frame of the machine at 13. The top ends 14 of these levers are connected by pins 15 16 and links 17 to small angle-pieces 18, which are pivoted at 19. The range of motion of these angle-pieces is limited by the plates 51
40 and 52. Attached to these angle-pieces are springs 20, which are fixed at one end in slots 21 in the angle-pieces 18. The springs 20 rest against the projecting tongues 22 of the angle-pieces 18. This arrangement allows the
45 springs 20, with their punch-blocks 23, to be freely depressed, but prevents them vibrating, as they would do without this support. Such vibration would be most detrimental, as it causes the punch-blocks to strike against ad-
50 joining mechanism, and though it does not prevent their rapid withdrawal it obstructs rapid return to normal position. (Shown in Fig. 4.) A shaft 27 is pivoted between the screws 28 29, Fig. 7. Rigidly attached to this
55 shaft are two thin sheet-steel bell-crank levers 30 31, arranged about an inch apart parallel to one another on said shaft, Figs. 4, 6, 7. Brazed crosswise to the outer extremities of these levers are two short universal striker-
60 bars 32 33, which extend over each of the two rows of five punches 34 35. To the lower extremities of the bell-crank levers 30 31 is attached a soft-iron armature-bar 36, which is controlled by the electromagnet 37. This
65 punch-striking mechanism is held normally retracted by the spring 43, which is attached to the post 95, Figs. 6 and 7. The screw 96,

Fig. 7, serves as the back-stop for the armature 36 of the punching-magnet. 38 is a die-
block. (Shown in section in Fig. 4 and en-
larged in Figs. 8 and 9.) The punches pass
70 through two hardened-steel guide-plates 39 and 40, Fig. 9, and may be driven into the holes in the hardened-steel die-plate 41. The
75 two guide-plates and the die-plate are dove-tailed into the die-block and locked by means of the tapering pin 42. By knocking out this
pin the die-plate 41 may be removed for sharpening. The paper tape to be perforated is in-
80 troduced sidewise into the thin slit 44 between the punches and the die-plate. 45 46
are springs for retracting the punches after perforating the tape. At one end they are
fixed in holes in the blocks 47 48. At the
85 other end they are reduced in diameter sufficiently to permit them to pass through holes drilled in the heads of the punches. The por-
tions of the springs which project through the punches rest against the stop 49, Figs. 8 and
90 9, which regulates the height to which the punches can rise. The disks punched from the paper tape pass down through the tube
50 to the floor.

The operation of the mechanism so far de-
scribed can be understood best from Figs. 4
95 and 5. When a key 3 is depressed, it forces down one or more of the fiddle-bows 6. These
in their turn depress corresponding kickers 7. The hooks 9 are thrust forward, and with
100 them the straps 10 and the perpendicular portion of the bell-crank levers 12. The hori-
zontal portions of one or more of the levers 12 are thus lifted about one-sixteenth of an
inch. This motion is communicated, by means
105 of the pins 15 and 16 and the links 17, to the angle-pieces 18, which tilt on their pivots 19, as shown in Fig. 5. One or more of the punch-
blocks 23 are in this way withdrawn from over the punches 34 35. The consequence is
110 that when the magnet 37 is energized and attracts the armature 36 the universal striker-
bars 32 33 strike down on the punches, but only operate those from which the punch-
blocks 23 have not been withdrawn. In this
115 way by depressing various keys it is possible to operate any combination of one or more
punches required to perforate the tape to represent a letter. It is obvious that the action
120 of this selecting mechanism may be reversed, so that the punch-blocks would normally rest
in the outward position shown in Fig. 5 and
would be thrust over the punches by depress-
ing any required key. The arrangement al-
125 ready described is preferable in a fast-operating machine, because the punch-blocks that
have to take part in the operation of punch-
ing any particular letter are stationary, not
having been shifted the instant before they
are struck. In the reverse arrangement, in
130 which the punch-blocks are thrust inward, there is hardly sufficient time for them to
come to rest when the keys are operated rapidly, the result being that some punches are
liable to miss.

The spacing mechanism is shown in Figs. 1, 2, 3, 6, and 7 and in Figs. 15, 16, 17, and 18. Referring to Fig. 7, rigidly attached to the shaft 56 there is a small sprocket-wheel 53, which feeds the tape 57 along by means of the central line of perforations. (See Fig. 3.) Rigidly attached to the same shaft as the sprocket-wheel is a small ratchet-wheel 54, controlled by an escapement-anchor 55, which is pinned to the shaft 62. The tape 57 passes up over the guide-plate 58, through the die-block, over the sprocket-wheel 53, and down over the serrated steel knife-blade 64 and out of the machine. The plate 64 (shown also in Fig. 2) is used as a support against which to tear off a section of tape when that is necessary. The tape is kept in contact with the sprocket-wheel 53 by the small rollers 59 60, carried by the spring snap-lever 61. When inserting the tape, this lever is thrown back to the position shown in dotted outline, and when the tape is adjusted on the sprocket-wheel the lever 61 is snapped back into normal position again. Referring now to Fig. 6, on the shaft 62, carrying the escapement-anchor, there is also rigidly attached an armature 65, which is normally held against the back-stop 66 by the spring 67. This armature 65 is controlled by the spacing-magnet 68, which thus controls the escapement-anchor, the ratchet 54, and the sprocket-wheel 53. The shaft 56, carrying the sprocket-wheel, is driven by any suitable motor, such as the small electric motor 138 shown in Fig. 3. In a machine of this character it is essential that the operation of feeding the tape shall be as rapid as possible, because upon the rapidity of the feed of the tape depends to a great extent the speed at which the machine can be operated. To start the feed rapidly, the sprocket-wheel 53 and its connections must be very light, so as to be able to snap around one step the instant they are permitted to do so by the movement of the escapement-anchor. There are three ways in which the sprocket-wheel may be driven by the motor. The first is to drive the motor at a high speed and connect it by a friction-coupling to the shaft carrying the sprocket-wheel. The escapement-anchor has then to resist the friction which tends to rotate the sprocket-wheel. To render this means effective, the motor has to be run at a high speed in order to give the sprocket-wheel sufficient peripheral velocity to feed the tape rapidly. The humming of the motor is then objectionable, there is considerable wear and tear, and it is difficult to maintain the friction sufficiently uniform. The second means is to drive the sprocket-wheel by means of a watch-spring, one end of which is connected direct to the shaft carrying the sprocket-wheel and the other end to the inside of a drum, which is kept wound up by the motor. With a small motor it is very difficult to avoid either over or under winding the watch-spring, with consequent irregularity in the rate of feed. The

third means, which forms part of my improvement, consists in combining said friction and spring devices. With this arrangement the motor can be run at a low speed—about three hundred revolutions per minute—and by adjustment of the friction the watch-spring is kept wound up to any degree desirable. This arrangement is shown in Figs. 1, 2, and 3 at 69 and 70 and in detail in Figs. 15, 16, 17, and 18. Fig. 15 is a section through Fig. 17 on the line K L. Fig. 16 is a section on the line M N, Fig. 17; and Fig. 18 is a section on the line O P, Fig. 17. 69 is a thin steel drum revolving freely on the shaft 56, to which is fixed the sprocket-wheel 53. 76 is the shaft of the motor. On this shaft is fixed a collar 70, expanded at the outer end into a disk 77, in which are two slots to hold the springs 73 74 from moving sidewise. The springs 73 74 are attached to the collar by the adjusting-screws 78 79, the disk acting as a fulcrum. Small pads of hard felt 71 72 are riveted to the free ends of the springs 73 74. These felt pads rub against the inner surface of the steel drum 69. Attached by one end to the drum, as shown in Fig. 18, is a watch-spring 75, the other end being attached to the shaft 56. The drum 69 is kept in place only by the attachment of the spring 75 to the shaft 56. In practice this is found to be sufficient. The rotation of the motor-shaft causes the friction-pads to keep the watch-spring 75 wound up, thus supplying quick-acting power to drive the sprocket-wheel. The result is that every time the spacing-magnet 68 is energized and deenergized the tape is fed forward the length of one letter-space.

The punching and spacing magnets are operated alternately by two electric contacts. The arrangements connected with these contacts are shown at 80, Figs. 1, 2, and 6 and in enlarged details in Figs. 13 and 14. Inspection of Figs. 2 and 3, and preferably the latter, will show that while the ten fiddle-bows 6 are pivoted so as to rock up and down on the same shaft 4 as the keys 3 and the kickers 7 there is an eleventh fiddle-bow 81, which rocks on a separate shaft 82. This outside fiddle-bow, which is operated by each and all the keys, controls the punching and spacing contacts. The ten kicker fiddle-bows are held up by the kicker-springs; but the fiddle-bow 81 is held up by springs 83 84. Projecting upward from 81, as shown in Fig. 6, is a section of thin tube 85, flattened at the lower end for attachment to the fiddle-bow and at the top to carry a short insulated arm 86, projecting horizontally at right angles to 85. This arm carries double contact-points 87 88, electrically united, which make contact alternately with the punching and spacing circuits as the various keys are depressed and released, the keys depressing the fiddle-bow 81, and thus rocking the contact-arm 86. Referring to Figs. 13 and 14, Fig. 13 is a plan view, and Fig. 14 is a side elevation. The

contact-arm 86 makes contact alternately with the punching-contact 91 and the spacing-contact 94. Normally when the keys are not being depressed the arm 86 remains in contact with the spacing-contact 94. Consequently when circuit is closed preliminary to operating the machine, the spacing-circuit being closed, the spacing-magnet 68 is energized and attracts its armature 65. The escapement-anchor 55, Fig. 7, is thus drawn over, so that a tooth of the ratchet is retained by the arm 63 of the anchor. This is the normal condition of the spacing mechanism, the feeding of the tape being effected by the breaking and closing of the spacing-circuit. When a key is depressed, the spacing fiddle-bow 81, Figs. 13 and 14, breaks the spacing-contact 94 the moment the key is touched. This releases the armature of the spacing-magnet, the anchor flies back, and the sprocket-wheel feeds the tape forward about one-third of one letter-space. The further depression of the key carries the contact-arms, Fig. 14, over to the punching-contact 91. The moment this happens the punching-armature 36, Fig. 4, is attracted by its magnet, and the striker-bars 32 33 strike down the selected punches, driving them through the paper tape. On releasing the key the punching-circuit is broken, the striker-bars fly up again, the punches are drawn out of the tape, and then the moment the contact-arm 86 touches the spacing-contact 94 the spacing-circuit is closed again and the paper tape is fed forward the remaining two-thirds of the letter-space. What actually happens is that just prior to depressing a key one-third of the last letter punched remains under the punches. The breaking of the spacing-circuit by depressing a key moves the tape forward one-third of a letter-space, thus bringing a new letter-space in proper alignment under the punches. In order that the machine may work rapidly, it is necessary to have a considerable gap between the punching and spacing circuit contacts, so as to allow time for the tape to feed before the punching begins. Set-screws 89 90, Figs. 13, 14, are provided for adjusting this gap. They are insulated and carried by two posts attached to a bracket 80, which is screwed to the frame of the machine. Experience shows that there is a decided tendency on the part of the contact-arm 86 to chatter on the contact 94 when a key is suddenly released, and this chattering feeds the tape forward several spaces after each letter. To obviate this difficulty, I make the mechanism very light and employ a yielding spring-contact 92, Fig. 13, with a limiting-stop 93, allowing a movement to the spring of about one sixty-fourth of an inch. This spring-contact prevents the contact being broken by any slight vibration of the contact-arm, and by making the fiddle-bow and contact-arm very light and holding them up firmly by the springs 83 84 chattering is prevented. A very thin light fiddle-bow offers but slight resistance to torsion, and conse-

quently if it is pivoted on shaft 4 with the other fiddle-bows when the key Q, Fig. 2, is depressed, owing to the twisting of the fiddle-bow, the contact-arm hardly breaks the spacing-contact and will not touch the punching-contact, though letter "P" at the other end of the keyboard works perfectly. I therefore provide a separate shaft 82, Figs. 3, 13, and 14, to which the light fiddle-bow is rigidly attached at both ends. The shaft 82 then takes up the torsional strain, and the fiddle-bow is not distorted by the depression of any key. These arrangements abolish chattering, and the keyboard of the machine may be operated as fast as that of any type-writer.

Referring to Figs. 8 and 9, it is necessary to be able to remove the punches readily in order to be able to sharpen or replace them by new punches. This is readily done with the mechanism shown by forcing up the under sides 97 98 of the springs 45 46 out of their holes in the blocks 47 48. The springs can then be pulled out of the punches and the punches pulled out of the die-block. To facilitate the operation, the die-block itself is made readily removable, the screws 99 100, which hold the die-block down firmly on the frame 2 of the machine, engaging in slots 101 102, cut in the two wings of the die-block. A single turn of each of these screws releases the die-block, and it can then be readily removed. The paper-guide plate 58 is provided with two flanges 103 104 to guide the tape, and in order to prevent the tape jumping out of the guide there is provided a spring snap-lever 105, to which there is attached a projecting wire rod 106, which fits into notches in the flanges of the guide-plate and keeps the tape in place. To remove the tape, the lever 105 is thrown down to the dotted position shown in Fig. 9, and the roller-lever 61, Fig. 7, is also thrown over to its dotted position. The tape can then be readily slipped out or inserted sideways.

In the printing-telegraph system described in my said prior granted patents when printing long messages, such as press-despatches, there is no difficulty in stopping the printer at any appropriate place near the end of a line and running the type-writer carriage back; but when handling short messages, such as commercial telegrams, consisting mostly of short lines which cannot be arbitrarily divided like a press-despatch, it is necessary to have a break-signal which will automatically stop the printing mechanism at the end of each line. This break-signal has to be transmitted like any other letter by perforating it in its appropriate place in the transmitting-tape. In order to insert the break-signal at appropriate intervals, it is necessary to have a locking device to prevent a perforator operator exceeding the length of a line before inserting the break-signal. For this purpose I have devised a locking or blocking device, which is shown immediately under the keyboard in Fig. 1, also in front ele-

vation in Fig. 19, and in plan, with the key-board removed, in Fig. 20.

Referring to Figs. 19 and 20, 107 is a letter-scale. 108 is an actuator which is attached to the chain or cord 109 and slides step by step along the scale as each key is depressed. This movement is secured by having the counting-magnet 110 included in the circuit of the spacing-magnet, so that every time the spacing-magnet is operated the counting-magnet attracts its armature 111, pivoted at 112, and depresses the arm 113, with its pawl 114. This pawl strikes the ratchet-wheel 115 and moves it around the extent of one tooth. A wedge-shaped stop 116 prevents overfeeding, and the holding-pawl 117 keeps the ratchet from flying back. On the same shaft as this ratchet and secured to it is a small drum 118, containing a watch-spring. The cord or chain 109 winds up and unwinds from the drum as the ratchet is stepped around by the counting-magnet in opposition to the watch-spring in the drum. In this way the indicator 108 is moved along till it comes to the end of the line. It then strikes an upward prolongation 119 of a light toothed bar or lock-bar 120, which slides back and forth about one-sixteenth of an inch on the screws 121, the screw-holes being slotted sufficiently to permit the motion. The spring 124 normally keeps the bar 120 to the left, so that the teeth of the bar do not obstruct the downward motion of the keys 3. When the actuator 108, carried along by the chain or cord, strikes the prolongation 119, the toothed lock-bar 120 is moved to the right and the teeth 151 are brought under the keys 3, thus locking or preventing them from being depressed. It is now necessary to depress the one unlocked key, which will insert the break-signal in the tape and at the same time release the indicator, so that it will return to the beginning of the scale, ready to advance the actuator for the next line and also unlock the keys. In transmitting commercial telegrams by this system it is found preferable to use capitals and figures only. The capital-shift-key, therefore, not being required for commercial telegrams, it is available for use as a break-signal key. The tooth 152 of the locking-bar, which would otherwise lock the capital-key like all the other keys, is therefore cut away, so that the capital-key is free to be depressed when all the others are locked. The capital-key is in position to engage the end 122 of the pawl 117. When the actuator has come to the end of the line and locked the machine, the capital-key is depressed. This punches in the tape the group of perforations composing the break-signal. It also breaks the spacing-circuit, and therefore deenergizes the counting-magnet 110, which releases its armature 111 and pawl 114. The capital-key also strikes the end 122 of the pawl 117, tilts the pawl up, and allows the ratchet-wheel to fly around under the influence of the spring in the drum.

This carries the actuator back to the beginning of the line, the exact point being fixed by the Geneva stop 123 on the ratchet-wheel. In order to moderate the speed with which the actuator flies back to the beginning of the line, a small vibrating anchor 153 engages with the teeth of the ratchet. The pressure of the indicator on the projection 119 being removed, the bar 120 is thrown back to its normal position by the spring 124. The depression of the capital-key, therefore, perforates the break-signal in the tape, returns the actuator to the beginning of the line, and unlocks all the keys ready for the next line. Occasionally it is desirable to run the actuator back to the beginning of the line without punching a break-signal in the tape. This is done by means of the key 125, which on being depressed short-circuits the controlling-magnet 110 without affecting the spacing or punching magnet and trips the pawl 117 by means of the hook 126 and the pin 127. The switch 128 is for cutting the locking mechanism into or out of action, as desired.

The general plan of the circuits of the machine is shown in the diagram Fig. 21. The current to run the motor 138 is supplied to the binding-posts 129 130 and the motor is started or stopped by the switch 137. The current to operate the punching and spacing magnets, which for convenience may be drawn from an electric-lighting circuit, enters the machine at the binding-post 136. When no key is being depressed, the contact-arm 86 rests in contact with 94 and current passes from the binding-post through the contact-arm 86, contact-point 94, wire 141, switch 128, wire 142, binding-post 133, resistance 140, binding-post 132, wire 143, magnet 68, switch 139, wire 144, and out through the binding-post 131 back to the source of power. The spacing-circuit is therefore always closed except when a key is depressed, the feeding of the tape being therefore effected by the momentary breaking of a closed circuit. When a key is depressed, contact-arm 86 goes over to contact 91 and the current passes through wire 148, punching-magnet 37, wire 149, switch 139, wire 144, and out through the binding-post 131 back to the source of power. When the switch 128 is in the position shown in the diagram, the locking mechanism is cut out and inoperative. When the tape has to be perforated with commercial messages, which as a practical necessity require the use of break-signals to indicate the end of lines, the locking mechanism has to be employed. The switch 128 is then thrown over to contact 150. This cuts in the locking mechanism. Magnet 110 is in the same circuit as the spacing-magnet 68. It therefore operates by the momentary opening of the normally closed spacing-circuit. When it is desired to release the locking-magnet independently of the spacing-magnet, the short-circuit key 125 is depressed, cutting out the magnet 110 by the

short circuit from wire 145, through key 125 and wire 147, to wire 146. The switch 139 is in the common return branch of the punching and spacing circuits. Opening this switch therefore cuts off the current by means of which the machine is operated. Closing the two switches 137 and 139 makes the machine ready for operation. The punching-magnet 37 requires much more current to operate it than the spacing-magnet. As this latter magnet is small the extra resistance 140 has to be placed in the spacing-magnet circuit to reduce the current when it is flowing through the spacing-circuit. The locking-magnet 110 has about the same resistance as the extra resistance 140. Consequently it will be seen that the switch 128 is so arranged that when it cuts in the locking-magnet it cuts out the extra resistance 140. To obviate trouble caused by sparking at the contact-points 91 94, it is necessary to bridge the gaps with the usual arrangement of a condenser and resistance in series connected between binding-posts 134 and 136 and 135 and 136, with their connections provided for this purpose.

What I claim, and desire to secure by Letters Patent, is—

1. In a keyboard-perforator the combination of a series of independent keys, a series of independent punches arranged to perforate a tape or strip, an operating or striking device common to all said punches, a series of independently-movable mechanical devices arranged to make and break the mechanical connection between said punches and striking device, means for operating said striking device by the depression of a key, and means for changing the position of one or more of said mechanical connecting devices during the movement of a key-lever and prior to the operation of the striking device.

2. In a keyboard-perforator the combination of a series of independent keys, a series of independent punches arranged to perforate a tape or strip, an operating or striking device common to all said punches, a series of movable mechanical connections normally in position to connect said punches and striking device, an electromagnet to operate said striking device, a circuit therefor, a circuit-closer operated upon the depression of a key and means whereby one or more of said mechanical connections is removed during the depression of a key and prior to closing the circuit.

3. In a keyboard-perforator the combination of a series of independent key-levers, a series of separately-movable punches arranged in two parallel, equidistant and coextensive rows to perforate a tape or strip, a striking device to simultaneously actuate said punches and means for dividing said punches into two groups and subjecting one group to the action of said striking device consisting of a series of separately-movable sections or blocks, one for each punch, each section being supported upon a hinged or pivoted arm

and a separately-movable mechanical connection between each block and said key-levers.

4. In a keyboard-perforator the combination of a series of independent key-levers, a series of separate, uniform punches arranged in two parallel, equidistant and coextensive rows, a striking device for said punches, a series of sections or blocks, one for each punch, each block supported upon the free end of a hinged or pivoted lever and movable in the arc of a circle and means for shifting the position of one or more of said blocks to subject one or more punches of each row to the action of the striking device.

5. In a keyboard-perforator the combination of a series of independent key-levers, a series of separate, uniform punches arranged in two parallel, equidistant and coextensive rows, a striking device for actuating said punches, a series of blocks, one for each punch, each supported upon a hinged or pivoted arm, and movable into and out of line with said punches, respectively, a mechanical connection between each block and said key-levers, and means for feeding a tape or strip a uniform distance upon each complete operation of the striking device.

6. In a keyboard-perforator the combination of a series of independent key-levers, a series of separate, uniform punches arranged in two parallel, equidistant and coextensive rows, a striking device for actuating said punches, a series of blocks, one for each punch, supported upon a hinged or pivoted arm, and movable into and out of line with its punch, a mechanical connection between each of said arms and said key-levers, means for feeding a tape or strip a uniform distance upon each complete operation of the striking device, an electromagnet to operate the striking device, an electromagnet to operate the spacing device, electric circuits and connections therefor, and a circuit-controlling device operated by the movement of the key-levers.

7. In a keyboard-perforator, a series of independently-movable, uniform punches arranged in two parallel, equidistant and coextensive rows to perforate a tape or strip in parallel lines, a universal striker-bar for said punches, a series of independently-movable key-levers, means for subjecting one or more of said punches to the action of the striker-bar upon the depression of a key-lever, an electromagnet to operate the striker-bar, an electric circuit therefor, and a circuit-closer operated by the key-levers.

8. In a keyboard-perforator a series of independently-movable punches arranged in two parallel, equidistant and coextensive rows to perforate a tape or strip in parallel lines, a striker-bar for said punches, a series of independently-movable key-levers, means for subjecting one or more of said punches to the action of the striker-bar upon the depression of a key-lever, a motor-driven sprocket-wheel and an escapement therefor to advance the tape or strip a series of successive uni-

form steps upon each operation of the striker-bar, an electromagnet to operate said bar, an electromagnet to operate said escapement, an electric circuit therefor, and a circuit-closer controlled by the key-levers.

9. In a keyboard-perforator a series of independently-movable punches arranged in two parallel, equidistant and coextensive rows to perforate a tape or strip, a universal striking device for the punches, a series of independently-movable key-levers, means for subjecting one or more of the said punches to the action of the striker-bar upon the depression of a key-lever, a motor-driven sprocket-wheel having an escapement arranged to advance the tape or strip, step by step, a uniform step or distance at each operation of the striker-bar, an electromagnet to operate the striker-bar, an electromagnet to operate the escapement, an electric circuit for said magnet, a normally open branch of said circuit including the coils of the striker-bar magnet, a normally closed branch of said circuit containing the coils of the escapement-magnet and a circuit-closer operating break-points in said branch circuits alternately, under control of said key-levers.

10. In a keyboard-perforator the combination of a series of separately-movable punches arranged to perforate a tape or strip, a universal striking device for said punches, an electromagnet with its circuit and circuit-closer to operate said striking device and means to advance the tape or strip a uniform distance upon each complete operation of said striking device, said means including an electromagnet, an electric circuit and circuit-closers controlled by the key-levers, so arranged that the depression and release of a key first operates the escapement-magnet, second the punching-magnet, and third, the escapement-magnet, in the order named, to produce sectional advance movements of a single uniform step or letter-space of the paper-feed.

11. In a keyboard-perforator the combination of a series of independent key-levers, a series of separate punches, a universal striking device for said punches, a movable block for each punch, carried upon a pivoted lever, a hinged mechanical connection between each lever and a series of pivoted block-selecting devices, means for actuating one or more of said selecting devices upon the depression of a key-lever, an electromagnet for operating said striking device, an electric circuit therefor, and a circuit-closer operated by the key-levers.

12. In a perforator a series of independently-movable punches in combination with means for actuating one or more of said punches, consisting of a universal striking device, a movable block for each punch, a series of pivoted levers or "kickers" in number corresponding to the number of punches, a separable mechanical connection between said levers or "kickers" and said blocks, re-

spectively; and means for actuating one or more of said levers consisting of a series of independently-movable key-levers characteristically slotted and a series of hinged strips or "fiddle-bows."

13. In a perforator a series of independently-movable punches in combination with a universal striking device, a movable block for each punch supported upon a pivoted lever, a series of pivoted levers or "kickers" in number corresponding to the number of punches, a mechanical connection between said levers or "kickers" and the levers supporting said blocks, respectively, and means for actuating one or more of said levers or "kickers" consisting of a series of independently-movable key-levers characteristically slotted upon their contact-surfaces and a series of hinged strips or "fiddle-bows" in position to engage with said levers or "kickers."

14. In a perforator an electromagnetic punching device and an electromagnetic spacing device, an electric circuit for the electromagnets having two branches, a punching-magnet in one branch, a spacing-magnet in the other branch, a series of independent key-levers, a normally closed circuit-breaker in the escapement-magnet branch, a normally open circuit-closer in the punching-magnet branch, and means whereby the depression of a key operates said circuit-breaker.

15. In a perforator the combination of a paper-punching device and a paper-feeding device, a motor-driven sprocket-wheel over which the paper strip is passed, a constantly-operating motor-driven shaft, a friction-clutch and a helical spring connecting the sprocket-wheel shaft with the motor-driven shaft and an electromagnetic escapement for said sprocket-wheel.

16. In a keyboard-perforator the combination of a series of separately-movable punches, means for selecting and operating one or more of said punches and means for advancing a paper strip step by step consisting of a constantly-operating motor-driven shaft, a sprocket-wheel and its shaft, a friction-clutch connected to said motor-shaft, a helical spring uniting said sprocket-wheel shaft to said clutch, an electromagnetic escapement for said shaft, an electric circuit in which the escapement-magnet is located and a circuit-breaker in said circuit controlled by the punching device.

17. In a perforator an electromagnetic punching device combined with an electromagnetic paper-feeding device and means for advancing the paper strip a uniform and equal step or space for each character perforated consisting of an electric circuit including said electromagnet and a circuit-closer controlled by the depression of a key to operate the escapement-magnet, the punching-magnet, and the escapement-magnet in the order named whereby said space or step is produced by sectional advance movements.

18. In a perforator the combination of a series of independently-movable punches, a punching-magnet, a spacing-magnet, an electric circuit for said magnet, a series of independent key-levers, separable mechanical connections between the key-levers and the punches including a series of pivoted spring-retracted levers or fiddle-bows, a circuit-closer in said circuit and means for operating said circuit-closer by the depression of a key-lever consisting of a spring-retracted lever or fiddle-bow on an independent support arranged parallel with the said series of fiddle-bows and an operating connection between said fiddle-bow and the movable element of said circuit-closer.

19. In a perforator the combination of a punching device, a spacing device, a series of independent key-levers and means for blocking the movement of said key-levers at a predetermined point consisting of a locking-bolt normally out of engagement with said levers, a traveling actuator therefor, a pawl and ratchet mechanically connected to said actuator, an electromagnet to operate said pawl, an electric circuit therefor and a circuit-closer in said circuit operated by the spacing device.

20. In a perforator the combination of a punching device, a spacing device, a series of independent key-levers, and means for blocking the movement of said key-levers at a predetermined point consisting of a toothed strip normally out of engagement with said levers, an actuator therefor advanced step by step to move said strip, a retracting device for said strip, a pawl and ratchet to operate said ac-

tuator and means for operating said pawl upon the operation of the spacing device.

21. In a perforator the combination of a punching device, a spacing device, a series of independent key-levers to control the punching and spacing devices and means for blocking the movement of said key-levers at a predetermined point in the operation of perforating consisting of a spring-retracted toothed strip, an actuator therefor, a pawl and ratchet to advance said actuator step by step and an operating connection between said pawl and the said key-levers.

22. In a perforator the combination of a punching device, a spacing device, a series of independent key-levers, a locking device for said key-levers, an actuator for said locking device, a pawl and ratchet to advance said actuator step by step, a retracting device for said actuator, a retracting device for said locking-bolt and means for releasing the actuator-retracting device.

23. In a perforator the combination of a punching device, a spacing device, a series of independent key-levers, a locking device for said key-levers, an actuator for said locking device, a pawl and ratchet to advance said actuator step by step, an electromagnet to operate the pawl, an electric circuit therefor, and a circuit-closer in said circuit operated by the depression of a key-lever.

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